Enhancing the Nutritional Quality of Relief Diets Workshop Proceedings

---

April 28-30, 1999
Washington, DC USA

October, 1999

This workshop and publication were made possible in part through the support provided to Food Aid Management (FAM), SUSTAIN (Sharing U.S. Technology to Aid in the Improvement of Nutrition), and the Food and Nutrition Technical Assistance (FANta) Project with funds from the Office of Health and Nutrition of the Bureau for Global Programs Field Support and Research, and the Offices of Food for Peace and Program, Planning and Evaluation in the Bureau for Humanitarian Response at the United States Agency for International Development (USAID). This work was completed in part under terms of Cooperative Agreement No. DAN-A-00-91-00066-00 awarded to the Program for Appropriate Technology in Health (PATH) and HRN-A-00-98-00046-00 awarded to the Academy for Educational Development (AED).

In addition to the support of USAID, advice, organizational support, and in-kind assistance were contributed by the following organizations towards to organization of the workshop and review and publication of this document: The American Red Cross, the Congressional Hunger Committee, FMA, Inc., International Life Sciences Institute (ILSI), the Council for Responsible Nutrition, and The Micronutrient Initiative of Canada.

Photo Credits

Front cover: *(salt fortification*) The Micronutrient Intiative/Janice L. Johnston: Double Fortified Salt Project, Ghana.
(*refugee children with food aid)* UNHCR/9229/1979/Pierre Jambor: Cambodian refugee at Sakeo Holding Center, Thailand.
(agricultural production) World Vision International/Jakob Akol: # 17575-18, Zaire.
(food aid distribution) UNHCR/21049/08.1991/B. Press: Ethiopian refugees at Walda refugee camp, Kenya.

Back cover: *(Iraqi refugee camp)* UNHCR/ 21015/1991/Anneliesse Hollman: Iraqi refugees at Yekmal camp, Sirnak Province, Turkey-Iraq border.

Design Credits

Margie Ferris-Morris, Wendy Hammond, Trish Schmirler and Paige Harrigan

For additional copies of this report please contact:
The FANta Project
AED
1875 Connecticut Avenue NW
Washington, DC 20009 USA
(202) 884-8700
website: http://www.aed.org

This document can also be downloaded free from this website:
http://www.foodaid.org

ISBN # 1-930018-00-2

Contents

ACKNOWLEDGEMENTS

Editors-in-chief: Margie Ferris-Morris, Jenny Cervinskas and Sharon Bell

We would like to thank all those who contributed to the editorial process for their comments and review of the various iterations of the proceedings document, including:
Rita Bhatia, Patricia Bonnard, Bruce Cogill, Alison Greig, Steve Hansch, Paige Harrigan, David Huges, Sam Kahn, Teresa Lozeau, Tom Marchione, John Mason, Ritu Nalubola, Anne Ralte, Erica Stewart, Liz Turner, and Margaret Zeigler. The special assistance given during the editorial process by George Beaton is particularly appreciated.

Particular thanks are due to the whole staff at Food Aid Management, including Paige Harrigan for her time and dedication to seeing this workshop and proceedings through, to TJ Ryan for his support and management of the process, to Jessica Graef for developing a useful annotated bibliography on this subject and Sheryl Martin and Trish Schmirler for their extensive administrative assistance. A note of thanks is due to Wendy Hammond, who brought us to the final edit and design stage of this document.

We would also like to thank the Micronutrient Initiative of Canada for their editorial support and, in particular, Jenny Cervinskas and Alison Greig (MI) for all their support in planning and assisting at the workshop and throughout the development of the proceedings. A note of thanks is due to the USAID/MOST project for their ample provision of documentation for the workshop.

Special appreciation is due to the Council for Responsible Nutrition for making available Dan Shaughnessy to shepherd us skillfully through the workshop, and to Margie Ferris-Morris, who saw this workshop and proceedings through from start to finish. We also thank the dedicated speakers, many of whom contributed volunteer time to write and edit their presentations.

The American Red Cross' contributions to the wonderful workshop venue and food and the time dedicated by Margaret Stansberry to organizing the workshop logistics deserve particular recognition.

List of Acronyms

ACC/SCN	UN Administrative Committee on Coordination Sub-Committee on Nutrition
AICF	Action International Contre la Faim
CARE	Cooperative for American Relief Everywhere
CHW	community health worker
CIDA	Canadian International Development Agency
CRG	Commodities Reference Guide (USA)
CSB	corn-soya blend
EDTA	ethylenediamine tetra-acetic acid
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
HDR	Humanitarian Daily Ration
HINAP	Health Information Network for Advanced Planning (WHO)
ICRC	International Committee for the Red Cross
IDP	internally displaced person
IDRC	International Development and Research Centre/Canada
IEC	Information, Education and Communication
INCAP	Institute of Nutrition Central America and Panama (Guatemala)
IU	international unit
KIT	Royal Tropical Institute (Netherlands)
MI	The Micronutrient Initiative (IDRC/Canada)
MRE	Meals, Ready-to-Eat
MSF	Medicins sans Frontières/France
MSG	monosodium glutamate
MT	metric ton
NAMA	North American Millers Association
NAS	National Academy of Science (USA)
NDBC	National Dry Bean Council (USA)
NGO	non-governmental organization
ORT	Oral Rehydration Therapy
PL 480	Public Law 480, US Title II Food Aid
PVO	private volunteer organization (US-based)
RDA	recommended dietary allowance
RNIS	Refugee Nutrition Information System (ACC/SCN)
QAC	Quality Assurance and Control
SPHERE	Humanitarian Charter and Minimum Standards in Disaster Response
SUSTAIN	Sharing United States Technology in the Improvement of Nutrition
TQSA	Total Quality Systems Audit
UNHCR	United National High Commission for Refugees
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WFP	World Food Program
WHO	World Health Organization

Preface

This workshop was originally envisioned by a small group of individuals who saw a need to address the issue of nutritional quality of relief foods. The main objectives were to exchange information on current practices, and to compare operational approaches to enhancing nutritional quality of relief foods, especially micronutrients, with emphasis on exploring opportunities for and constraints to implementing small- and medium-scale fortification at local and regional levels.

Building on achievements in the past, the workshop was designed to address the growing realization that more can be done to address inadequate provision of nutrients and micronutrients in relief programs. Field evidence collected from the past two decades has drawn new attention to the severe inadequacies of vitamins and minerals in many relief diets. The experts in diverse technical fields who gathered at the workshop addressed the call to action described at the 1992 International Conference on Nutrition in Rome:

"*Among refugees and displaced populations, high rates of malnutrition and micronutrient deficiencies associated with high rates of mortality continue to occur. The magnitude of the problem has grown over the last decade. Increased political commitment to an accountability for the protection and promotion of the nutritional well-being of refugees, displaced populations, those under occupation, prisoners of war and other affected groups are urgently required in accordance with international humanitarian law. Governments, in collaboration with the international community, should: (Section 37)*

...Provide sustainable assistance to refugees and displaced persons and work to monitor and ensure their nutritional well-being, giving high priority to the control of diseases and to the prevention of malnutrition and outbreaks of micronutrient deficiency diseases. Wherever feasible, such assistance should encourage their ability to support themselves rather than increase their dependence on external assistance. The food provided should be nutritionally adequate and safe. (Section 37(a))

Governments should: ... Ensure and legislate for the fortification of foods or water with necessary micronutrients, where feasible, when existing food supplies fail to provide adequate levels in the diet. (Section 43f)

... Recognize that refugees and displaced persons, as well as being susceptible to iodine, vitamin A and iron deficiencies, are also susceptible to other deficiencies, particularly vitamin B1 deficiency (beriberi), niacin deficiency (pellagra), and vitamin C deficiency (scurvy). Donor countries and involved organizations must therefore ensure that the nutrient content of food used for emergency food aid meets nutritional requirements, if necessary through fortification or ultimately through supplementation. The extent possible, such foods should be culturally appropriate. (Section 43(m))"

The potential benefits of sharing the knowledge we have gleaned thus far with a wider audience are sizable. The diverse approaches discussed in the workshop require a broader involvement of the private and public community. These approaches, ranging from regional and local level food fortification to capsule supplements, home gardening, and improved micronutrient seed quality are shared in this document.

Executive Summary

An international workshop with 105 participants from non-governmental organizations (NGOs), industry, United States Government, academia, and development assistance agencies was held to discuss and recommend strategies to improve the nutritional quality of diets for refugees and displaced persons[1] in emergency.[2] and relief situations.[3] Over the past two decades, frequently cited evidence has drawn attention to the inadequate levels of calories, vitamins, and minerals in food aid, and nutritional deficiency diseases are still too often prevalent in relief situations. While the nutrition community has found practical new approaches to improving diets, this knowledge is not yet adapted for or applied adequately in emergencies.

The micronutrient needs of malnourished refugees and displaced persons in need of nutritional rehabilitation are higher than those of normal populations, especially for vitamins A and C, B vitamins, iron, iodine, zinc, and selenium. Micronutrient deficiencies are already common in such areas of extreme rural poverty as marginal agricultural land and landlocked mountainous regions. These deficiencies are often called "hidden hunger" because their effects are often unnoticed and only their severe forms are apparent clinically (see Appendix E for prevalence tables and map). In emergencies, micronutrient malnutrition[4] is manifested as conditions like scurvy, vitamin A deficiency, anemia, goiter, and pellagra. Micronutrient inadequacies, even without the appearance of classical deficiency diseases, undoubtedly increase disease and death rates in populations relying solely on long-term food assistance programs. Further, these deficiencies have long-term effects on quality of life beyond their short-term presentation in emergencies. Basic nutritional needs all too often go unmet, particularly, but not only, in the emergency phase of relief situations when total caloric supply is often grossly inadequate.

One possible solution to micronutrient malnutrition in relief situations is fortification of food aid. Fortification of selected food relief items is being done, and done successfully. However, a number of political, technical, and financial constraints specific to emergency and relief situations must be faced. For example, the financial constraint in using processed foods lies in the costs of processing, handling, and distributing the food, rather than in the cost of fortification per se. One important technical constraint is maintaining longer shelf-lives for food, since certain micronutrients are lost during transport, distribution, storage, and preparation. These factors imply the need for careful choice of transport vehicles and fortification sites. In addition, levels of fortification and standards of uniformity of micronutrient density raise certain questions. Fortification of relief foods can be done in donor countries, at regional locations, or in-country.

---

[1] ***Refugees and displaced persons*** are persons who leave their homes to escape persecution, war, human rights abuse, or natural and/or manmade disaster. Refugees leave their countries of origin to seek asylum from a foreign government or power. Internally displaced persons, or IDPs, reside within their countries of origin.

[2] ***Emergency*** is defined here as a rapid-onset or prolonged onset natural or manmade disaster. The emergency phase of relief operations may last a few weeks up to a few months.

[3] ***Relief situation*** is broadly defined here to include any phase in an emergency (onset, transition) and could include populations receiving food aid up to a decade or more.

[4] ***Micronutrient malnutrition*** results from a biological deficiency of one or more micronutrients essential for normal growth and development. The most common micronutrient deficiencies of serious public health significance are vitamin A, iodine, and iron and folic acid. Action to address zinc deficiency is increasingly being urged in many countries.

Fortifying food at the local level[5] can overcome some of the above constraints in practical and sustainable ways.

Food fortification may be a better way to reach large populations than distribution of vitamin capsules or tablets. While distributing vitamin tablets to vulnerable populations in relief settings is often an effective way to prevent micronutrient deficiencies, the distribution itself involves such delivery problems as availability of capsules, distribution mechanisms, monitoring, and costs. Other possible ways to address micronutrient deficiencies in emergency situations are distributing seeds and/or fortified condiments with rations, improving seed quality, and promoting home or community gardening.

Progress in improving refugee diets

Although much remains to be done, the past decade has seen significant accomplishments in this arena. Some of the most noteworthy are:

- iodization of salt
- fortification of vegetable oil with vitamin A
- development of fortified premixes[6] with multiple micronutrients
- pre-positioning of relief foods for faster access and delivery to relief situations
- fortification of flours and blended foods
- preparation of memoranda of understanding for acceptable nutritional responses (by World Food Program, UNHCR, UNICEF, and others)
- issuance of minimum standards for relief response, including standards for food and nutrition (by SPHERE and others)
- improvement in monitoring, evaluating, and reporting on nutritional situations, which have made response and action more accurate

Themes and recommendations emerging from this workshop

In many situations, the inadequate nutritional quality of available relief foods may contribute to excess morbidity and food insecurity. The nutrient quality of relief foods can be improved by using available technologies and applying them more extensively in relief situations.

> *Working together, industry and donors could develop a wider range of cost- effective fortified foods and condiments designed to be acceptable to target populations and fill the nutrient gaps in existing diets. Of paramount importance is the acceptability of the foods to displaced persons. NGOs can make a major contribution in this area based on their field experience. Agencies in the field could extend advocacy and education concerning traditional local practices with potential to enhance micronutrient supply (iron cooking pots, ash, seed germination, dried fruits and vegetables, nutrient-rich sauces and seasonings, etc.), and donors and NGOs could facilitate this advocacy using available knowledge and tools. Governments, donors, and NGOs could consider allowing and*

[5] For this document, ***local level fortification*** refers to fortification that takes place in the country of distribution to displaced populations, in a large-scale milling plant or village or relief camp location. ***Regional fortification*** is fortification that takes place in one or more locations close to the countries of distribution, for distribution to one or more regional locations. ***Donor country fortification*** takes place in the donor's country of origin.

[6] ***Premix*** is a specially formulated mix of nutrients and vitamins ready to add to cereals, complementary foods, and other food items for fortification**.**

facilitating local barter of relief foods where current research indicates this is likely to enhance the micronutrient adequacy and acceptability of the refugee diet. Experts from the United Nations agencies, industry, and academia, and NGOs with field experience, could collaborate to review nutritional standards for individual classes of fortified foods and for combinations of such foods, and use them to meet the dietary needs of refugees.

More effective planning can result from considering past and present nutritional needs of refugees, and adapting a basic framework for responding, and responding more quickly, to emergencies.

Governments and donor agencies could acknowledge the need to improve relief diets and allocate more resources for this. Aid agencies could factor micronutrient and calorie needs into their food procurement, diet planning, and assessment from the outset. NGOs and donors could increase the quantity of prepositioned foods and fortified pre-mixes for emergencies. Donors and field-based agencies could consult and elicit the participation of food aid recipients when selecting food and seeds. Donors and field-based agencies could ensure that the right foods reach the right populations at the right time. Communication channels could improve all around— among donors, aid agencies, academia, industry, and displaced persons—through steering committees, Internet list serves, networks, and other means of sharing information, using new technologies and solutions. Successes and lessons learned in the above areas need better documentation and publicity.

While most of the basic research on fortifying relief diets has been done, a few issues still need attention for relief situations.

All partners need to develop field-friendly ways to assess nutrient deficiencies in populations and nutrient levels in foods at the point of consumption (quality control). Likewise, partners can continue to explore ways to add nutrients to acceptable food and condiments at low cost, and to preserve them for prolonged periods of time, as well as to develop "environmentally friendly" instant foods that are safe for use in refugee settings and that save labor and resources in preparation. NGOs need help to explore field possibilities of improving access, availability, and utilization of vitamin C-rich foods to prevent outbreaks of scurvy.

Because refugee diets are typically inadequate to meet nutritional needs, donors and field implementers have compelling ethical reasons to act. In actively addressing micronutrient deficiencies, these partners must take steps to safeguard human dignity and preserve lives in relief situations. Careful planning and assurance that people's nutritional needs are met are essential. The outputs of this workshop reinforce the fact that many cost-effective, useful, and sustainable practices exist, and these should be standardized, applied, or researched. Diversifying relief diets for food security is something we <u>should</u> do, not just something we <u>could</u> do.

WORKSHOP CONCLUSIONS

SECTION I: AREAS OF AGREEMENT AND AREAS TO EXPLORE

Common issues and areas of agreement emerged throughout the workshop. Although this report identifies key themes from the discussions, it does not represent a final consensus among technical experts, due to inadequate time to finalize detailed recommendations. The workshop was successful in bringing to light current knowledge and issues to inform people involved with funding, production, and delivery of food aid.

Relief agencies must respond to a great variety of emergencies. The diversity of acute emergency-relief-transition situations, along with the diversity of nutritional needs of populations at each stage of relief operations, makes it a challenge to establish a common framework and identify specific interventions. Workshop participants agreed that the conceptual framework developed by UNICEF to explain the underlying causes of malnutrition in stable populations is also relevant to emergencies.[7] Though food, health, and care may all mitigate the adverse impacts of emergency situations, the timeline of response to these underlying causes needs improvement.

A. Areas of General Agreement

Current Knowledge

We know that:

- Food aid recipients are experiencing micronutrient deficiencies.
- The nutrient quality of relief foods can be improved.
- Diets provided in the initial (acute) stage of a refugee crisis are grossly inadequate to meet the needs of normal people. Even if they meet energy needs, unless they are particularly well-balanced, they do not necessarily meet all nutrition needs. Needs of many micronutrients are certainly not met if energy needs are not met.
- Because people in emergency situations are often afflicted with more than one nutrient deficiency at a time, the need for more than the most common micronutrients (A, iron, iodine) must be addressed.
- Much of the technology to improve the nutritional quality of relief foods (i.e., fortification technology) is already established; the constraints are in developing, testing, and strengthening delivery mechanisms specific to emergency settings.
- For many classes of foods, fortification know-how exists and has been applied. Such application should be more extensive in relief situations; e.g., oil and milk powder delivered for vitamin A, cereal flour delivered for calcium, folic acid, iron, thiamin, riboflavin, and niacin; salt delivered with iodine; and sugar delivered with vitamin A.
- Now is the time to act to prevent micronutrient deficiencies in refugee/IDP populations. Since we know these populations are at high risk, we can take initial actions without waiting for more research and more conferences.

Multiple Approaches for Improvement of Rations and Diets

Participants concluded that:

[7] Refer to Appendix D for a more detailed description of the ***UNICEF Conceptual Framework***.

- Different settings require different combinations of approaches to preserving food security. A standard ration may not be suitable for all populations, nor for all people in those populations. Common approaches to addressing micronutrient malnutrition are: providing fresh and dried foods, diversifying diet, and fortifying food aid commodities.
- Relying on only one food product to deliver essential nutrients should be avoided because individuals who do not want to, or cannot, consume that particular food will not benefit from the intervention. Conversely, where it is possible to fortify the basic staple (e.g., cereal) consumed by the whole population, all micronutrients can be added to that food.
- The application of fortification technology must be applied urgently to local, often small-scale, food processing (identifying and utilizing local opportunities for action).
- Promising approaches to improving the nutrient quality of relief diets (e.g., fortification of staple cereals, fortification of vegetable oil, fortification of blended foods, monetization) need to be better documented and evaluated for cost-effectiveness, taste acceptability, and sustainability.

.

Targeted Population Approaches

When targeting populations for nutrition interventions, relief agencies in the field need to:

- Disaggregate populations' needs. The malnourished, in both supplemental and therapeutic feeding programs,[8] are likely to require a specially designed range of foods and nutrient supplements. Pregnant and lactating women have special needs, as do children of weaning age and the sick.
- Target households, not just vulnerable groups, and provide calorie- and nutrient-dense foods as a goal.
- Emphasize the need to promote continuation of breast-feeding during emergencies.

Fortification as a Solution

It has been long recognized that:

- Fortification is an effective way to improve and sustain the nutritional status of the general population. An integral component of a food assistance program should therefore be appropriate fortification of foods given to refugee populations.
- The taste and "look" of fortified foods must be acceptable to the consumers (in emergency populations, the refugees), as well as cost-effective for the donors.

Advocacy and Communication

Because politicians and policy makers can be influential in mandating the quality of relief foods if presented with correct information and convincing arguments, we need to advocate for improved relief diets by:

- Encouraging documentation of success stories and using this for advocacy purposes; and
- Placing micronutrient inadequacy on the agenda of international organizations (something we as a community have failed to do) and narrowing the communication gap among technicians, donors, government officials, and managers of relief operations.

---

[8] ***Supplementary Feeding Programs*** are administered when the nutritional needs of vulnerable populations (infants, children, pregnant and lactating women, the sick, the elderly) cannot be met by the general rations. Supplemental rations in the form of dry or cooked foods are provided for the vulnerable groups targeted. ***Therapeutic feeding*** is reserved for the severely malnourished and constitutes a feeding regimen designed for the individual's nutritional recuperation, usually taking into account other health problems (infections, edema, etc.)

Planning and Coordination
In planning for emergencies:

- The time factor in immediate response is critical. The risk of increased mortality is very high in the initial stage of an emergency situation.
- It is essential to consult with and seek the participation of refugees and displaced persons to identify dietary preferences and local agricultural practices, and to develop strategies to address longer-term nutritional needs.
- From the outset, we must make explicit how micronutrient needs are to be met. Nutrients that are likely to be deficient (for all groups, such as infants, children, adolescents, and adults, as well as any special needs for the sick and elderly) should be determined by calculating nutrient gaps in the mix of foods provided in the general ration.

Innovative Strategies
Innovative ways to improve the nutrient content of relief diets have been tried in many countries. Further documentation, assessment, and/or wider sharing of results are needed for such ideas as:

- Fortified locally used sauce (relish or seasoning) included in the food basket and added to the basic staples (cereals and pulses) at the point of consumption
- Portable kits of rapid-growing seeds and trays for growing herbs and spices with minimum effort or impact on natural resources in relief situations
- Trading of relief and other foods and increasing access to local markets, practices that should be encouraged wherever possible to help ensure diet diversity and decrease the risk of micronutrient malnutrition
- Micronutrient "Sprinkles" sachets (or fortified condiments) that could add valuable nutrients to staple foods if given out with relief rations
- Fortification of staple grains at small-scale milling facilities
- Fermentation/germination of grains

B. Areas to be Addressed

Conference participants highlighted the following as issues needing further exploration before consensus can be reached:

- How to initiate and speed up the relief response once nutritional deficiencies are detected?
- How to begin to match the nutritional design of a processed food with its intended use. Often-cited examples are CSB and similar foods? They were originally designed as weaning or complementary foods, used in nutrition rehabilitation, and then distributed as supplementary food for pregnant women. It is not clear whether the same nutrient profile would be appropriate for all these uses, or even whether the macronutrient composition should be the same for all. The fact that CSB was used successfully in emergency situations as a supplement to control specific micronutrient deficiency disease outbreaks does not imply that it was designed for such a purpose, or that it should be included in the general ration to solve the micronutrient inadequacies of that ration. Some participants in the meeting felt very strongly that if we could match design and use of fortified and specially formulated foods, we could do a vastly better job at targeting. This would require much better communication and collaboration than now exists.
- Whether to consider the nutrient quality of relief foods from the standpoint of their benefit primarily to women and children or to the entire family, and whether planners should consider only the requirements of people with the highest nutrient need? Participants did not discuss desirable and effective methodology for such assessment and planning, which

is a continuing source of controversy. Resolution of this question would be a major achievement.

- What staple foods and other commodities should be fortified, with how much of which nutrients, and where?
- How to give greater attention to quality control, too often a weak or nonexistent component of food fortification programs?
- Who will pick up the initial costs for fortified foods (the donor or the industry producing the fortified product)? In many cases fortification costs are considered nominal but processing costs major. One participant asked, "If a staple food is processed and fortified, will there be less overall food available for those who need it?" [9]
- How to prevent the incidence of vitamin C and niacin deficiencies, which, though relatively rare, have devastating effects? A review of approaches and the establishment of new approaches to prevent these deficiencies would be valuable.

Areas in which further exploration and/or research would be useful include:

- *Quality*. Can we get foods of high nutrient quality to people in emergency situations? Do agencies need a minimum amount of time to prepare effective interventions, e.g., to ensure availability of fortified blended food or cereal in sufficient quantities.
- *Aid monitoring*. Food aid efforts as well as efforts to fortify food aid commodities must be monitored and assessed. What is known about the nutritional impact of fortified food aid? Are target levels being met? How can we learn more about what happens in refugee households and monitor these situations to improve further actions?
- *Standards.* Standards for premix and fortified foods distributed to displaced persons should be reviewed by an appropriate technical body so that decisions can be made about whether there can be or should be universal standards for fortified staple foods and fortified specialty and blended foods. Where local premix standards exist, they could be harmonized with regional standards. Relief organizations should be aware of existing standards and major initiatives to develop new ones. In particular, it may be necessary to establish distinct standards for distinct purposes (e.g., treatment of malnutrition, rehabilitation of the malnourished, complementary feeding of infants, for the general population of refugees, and for different basic dietary staples).
- *Special situations*. Although relatively rare, vitamin C and niacin deficiencies do occur, and their devastating effects on their victims indicate serious underlying problems. Reviewing approaches and establishing new approaches to prevent these deficiencies would be valuable, but these clinically evident deficiencies must not become the sole focus of attention.
- *Assessing nutritional status.* We need to know what nutritional/health relationships can be inferred by combinations of anthropometric and other types of assessment (e.g., clinical signs and biochemical tests).
- *Local technologies*. The use of local and indigenous technologies to reduce costs of fortification (e.g., volumetric feeders for milling instead of industrially made feeders) needs further exploration and application. The feasibility of small- and medium-scale fortification of foods directed to relief and transition situations needs more testing. Large-scale fortification of cereals may be feasible in many countries. These trials should validate use of batch blending and mixing at the local level.

---

[9]One study in Latin American showed ***sugar fortified with vitamin A*** to be more cost-effective than vitamin A capsules or vegetable and farming promotion (Phillips M., Sanghvi T., Suarez R., McKigney J. and Fiedler J., "The costs and effectiveness of three vitamin A interventions in Guatemala." Soc. Sci. Med. 42 (12):1661-1668, 1996.)

SECTION II: RECOMMENDATIONS

In the second half of the workshop, participants met in small interest groups to generate recommendations for action and research in specific areas. Some of the recommendations below reflect ideas that arose in the first half of the workshop. Other ideas were not explicitly formed into recommendations. The main discussion topics were: how to improve the general ration; how to improve diets for special populations and situations; what processes are needed for these improvements; and what research is needed. Time constraints prevented full discussion or adoption of these recommendations by all workshop participants. Therefore, they are offered as suggestions for consideration rather than specific recommendations for action.

This interest group summary is divided into sections on improvement of the general ration; improvement of the relief diet for special situations; and improvement of the quality of food in and delivery of food to relief situations. A section on identified research needs follows the summary. Listed after many of the sections are the entities to whom the recommendations are addressed.

A. IMPROVING THE GENERAL RATION

The overall ration delivered in relief situations can be improved to better meet nutritional requirements. Recommendations for fortification of foods and agricultural approaches are given below:

1. Food Fortification

Nutritionists have long advocated for fortification because it is affordable and effective and brings a high return on investment. Fortification of foods is being explored in a number of countries at different levels (donor, country, regional, local). The nutritional advantages are well-established, but appropriate technologies for use in developing countries and relief situations have only recently been investigated. Appropriately fortified foods should be given to displaced persons whenever possible, and donors, industry, and field implementers should work together to determine optimal foods and cost-effective fortificants. Donors and relief planning agencies need to take into account micronutrient needs as well as calorie needs to create a balanced food ration for refugees and displaced persons.

- *Methods and suggestions to improve the general rations:*
  Aim to institutionalize fortification at the national legislative level so that the country's populace, as well as displaced populations, can reap economic, social, and nutritional benefits from fortification. (*International Organizations [IOs],national governments, donors)*[10]

- *Fortify:*
  salt - with iodine,[11] distributed as part of the general ration (salt is the most cost-effective vehicle for attacking iodine deficiency)
  staples - wheat and maize milled cereals, with multi-nutrients (A and B vitamins, iron, folate, zinc, and vitamin C when stable forms are available, etc.) for both

[10] Note: Suggested responsible parties italics and brackets were added by the authors post-workshop.
[11] Distribution of ***iodized salt*** is already the policy of WFP, which should communicate the policy widely to NGOs and others involved in procuring and delivering salt to refugees and IDPs.

displaced and national populations where micronutrient deficiencies exist; blended foods, as appropriate to the intended use
vegetable oil - with vitamin A and tocopherol (as both a nutrient and an antioxidant), assuring this practice continues

- *For local-level fortification:*
  Explore options for local fortification and advocate its potential benefits. Because NGOs and donors still need to be convinced of the merit and feasibility of local-level fortification, promote further studies. If fortifying for refugees, also consider the local population, and involve the local/regional private sector. *(NGOs and donors, national governments, refugees)*

  Develop regional centers to produce and supply fortified foods for longer-term relief situations and as part of the transition to development. Use centers already in place (as in Kenya, Zimbabwe, and Malawi, among others in Africa, and centers for oil processing/fortification in Asia). If there are no such regional centers, identify mills that could be used to fortify foods for refugees. *(UN agencies, donors, NGOs, national governments)*

2. Complementing Food Rations

Another method for improving the general ration is to complement it with agricultural intervention. Agricultural inputs by people with appropriate technical skills have long been used in rehabilitative strategies and should be an important part of nutritional interventions in many relief and transition situations. Opportunities for agriculture depend on land and water conditions and should build on such existing resources as the displaced population's knowledge of local wild foods and seeds. Crops with a market value should be encouraged so that the foods can be bartered or sold for complementary foods and/or condiments. Providing small animals for animal husbandry (e.g., guinea pigs, rabbits, and chickens), distributing seeds, and encouraging the sprouting of seeds can all be considered nutritional interventions.

- Consider local tastes and preferences when selecting crops and spices.[12] *(NGOs)*
- Establish a steering committee on agriculture in relief settings to follow up these recommendations.[13] As a first step, develop a clearinghouse (e.g., web page) for best agricultural practices in conflict-prone areas. *(NGOs, academia, private sector)*
- Explore alternative strategies/media for growing seeds quickly using minimal space. *(NGOs, academia, USDA, private sector)*
- Encourage the consumption of wild foods, which are often good sources of vitamins and minerals. Expand food composition tables to include more information about wild foods. Note foods with safety/toxicity issues. *(NGOs, academia, USDA)*

[12] Select ***spices*** high in micronutrients for the food basket (e.g., where acceptable, provide chili peppers as a source of vitamin C).
[13] ART (Agriculture in Relief and Transition) is the name of the ***steering committee*** formed during the workshop to raise awareness of how agriculture can enhance the nutritional status of displaced persons.

B. IMPROVING RELIEF DIETS FOR SPECIAL POPULATIONS AND SITUATIONS

Under certain circumstances, populations need extra nutrients, and vulnerable groups within those populations have additional nutritional burdens. It has been well documented that when displaced persons rely on food aid for extended periods of time, nutritional deficiencies may emerge, particularly micronutrient deficiencies such as scurvy, beriberi, and pellagra.

"Problem nutrients" as defined here are those nutrients that cannot be provided in sufficient quantities in typical food aid delivery programs to meet the specific daily needs of internally displaced persons (IDPs), as a result of which nutritional deficiencies develop. These nutrients include vitamin C, iron, iodine, and vitamin A, among others. For example, vitamin C receives frequent attention not only because body tissues can quickly become depleted of this vitamin leading to clinical deficiency, but because it is difficult to supply in relief diets due to restricted natural food sources and its low stability in fortified sources. Because of these constraints, vitamin C inadequacy is more likely in common refugee diets. Alternative approaches are needed for "problem nutrients," perhaps the use of capsule supplements or new technologies. For special populations, more food-based approaches targeted to the general population in relief settings, such as use of dried vegetables (recently added to the U.S. PL 480 docket) and dried or fresh fruits, could be developed. Any new approaches to improving diets would need piloting and evaluation.

Workshop participants agreed that supplementary/complementary feeding is usually indicated only for special subgroups in refugee populations, perhaps young children, pregnant women, and of course people undergoing specific nutrition rehabilitation. Participants did not agree on the desirability of using formulated and fortified foods to meet the micronutrient needs of the general refugee population.

The ultimate objective in improving relief diets is to provide access to a diverse diet of desired foods, rather than to rely on a patchwork of donated foods with logistical constraints and supply inconsistencies.

Two other problem nutrients were discussed at the workshop: zinc and iron. For iron in particular, improved fortification of donated food combined with traditional local approaches should increase bioavailability so it can be more effectively used in the body. It is not viable simply to increase the amount of iron in fortified foods, since only nominal amounts of added iron may be absorbed. Other strategies are accessing novel sources of minerals through cooking practices—the use of cooking ash, iron cooking pots, or galvanized tin containers as a source of zinc and other minerals. Traditional cooking and processing methods may already provide these minerals. Numerous appropriate technologies exist that are transferable to new relief settings.

The protein levels of corn-soya blend (CSB) need re-evaluation, especially in the absence of other essential nutrients for growth. Reducing the protein content of blended foods by three or four percent, which some participants felt would not detract from its functional utility, would lower its cost substantially and allow fortification with other nutrients. Another point for consideration in planning relief diets is that CSB is a higher-cost food than staples, is highly nutritious, and can be the only source of vitamin C in the

diet. CSB is often used in supplementary feeding programs, and when distributed in a general ration, is frequently traded because of its perceived value.

Specific recommendations:

- Communicate to medical personnel and others involved in emergency situations[14] the guidelines endorsed by WHO, WFP and UNHCR for micronutrient capsules/tablets/powders given to populations in emergency settings.
- When a food to be included in refugee diets is fortified, establish how it will be fortified and with what other foods it will be used. Consider fortification in terms of the total diet, not the quality of individual foods, unless these foods replace the total diet (as might be the case in treatment and rehabilitation of clinical malnutrition).
- Improve formulations of value-added/processed food aid by:
  -- adding bacterial phytases to CSB and other blended and complementary foods, and considering the advantages and disadvantages of adding heat resistant amylases
  -- using formulations containing EDTA,[15] to enhance the availability of iron and zinc *(UN agencies, industry, academia, research bodies).*
- Promote fermentation and germination technology at the household level (e.g., using baker's yeast rather than brewer's yeast) and promote select seed germination (thereby increasing the levels of vitamins C and B). (*UN agencies, NGOs, IOs, research bodies)*

C. IMPROVING THE ***DELIVERY*** OF ***QUALITY*** FOOD TO RELIEF SITES

If the general ration and diets for populations with special circumstances are to be improved, the following issues must be addressed: planning, training, communication, and donor/non-governmental/host national coordination; guidelines for fortified foods; and quality assurance and control mechanisms. Any efforts to improve these areas need to be supported with adequate and effective advocacy.

1. Planning, communications, and assessment

- Establish a better mechanism for communication between donors on issues related to fortified food aid commodities. Such issues include quality control and assurance, labeling (uniformity, manufacture date, ingredients, nutrient content), fortification specifications, premixes, equipment, and packaging issues. *(UN agencies, IOs, NGOs, industry, USDA)*
- Further capitalize on procuring and stocking premixes for inter-agency use so that they will be available when and where needed. There is currently an economy of scale and coordination problem, for example in parts of Africa. UN agencies are already showing leadership in this area. *(Donors, IOs)*
- Conduct regional- and country-level workshops on how to fortify foods commonly used in relief situations, particularly staples, and how to develop supply networks for delivering these foods in emergencies. *(IOs, NGOs, UN agencies, industry*)

[14] WFP/UNHCR Guidelines for Estimating Food and Nutritional Needs in Emergencies, Dec. 1997
WHO: Management of Nutrition in Major Emergencies, 1999.

[15] There is well-documented evidence that ***EDTA*** enhances the availability of iron for utilization. The effect of EDTA on other minerals should be examined.

- Explore and maximize ways to expedite information sharing about food aid planning and logistics among the NGO community, including more use of electronic bulletins, notices, and list serves. *(IOs, NGOs)*
- Enable more technology transfer, especially from donors to host countries, to help the latter make their own value-added foods. This would contribute to long-term sustainable development and would bring micronutrient fortification and delivery closer to the recipients. *(UN agencies, NGOs, industry, donors, IOs)*
- Develop better mechanisms for communicating with and training displaced persons about nutrition issues soon after the onset of emergencies. *(Donors, NGOs, IOs, academia, planners)*

2. Guidelines/standards for fortified foods

Composition of the premix and fortified foods distributed to displaced persons should be reviewed. Universal, regional, or national standards should be established (not standards for specific refugee groups). These guidelines should be developed or reviewed by an appropriate technical body. *(UN agencies, donors, NGOs, IOs, academia)*

3. Quality assurance and control

- Adapt and employ quality assurance and control programs (QAC) for fortified foods. This should include proper packaging to ensure that food is protected from production point to consumption point. Donors should take the steps under their control needed to ensure their donated food is of high nutritional quality and composition. Discussion of QAC should focus not only on large-scale industrialized settings, but also on need-based practical approaches suitable for local small-scale processing, which will undoubtedly be very different. *(Donors, NGOs, IOs, industry)*
- Include measuring the nutrient levels in foods as an important aspect of a good QAC. It may be possible to provide field implementers with testing kits for micronutrient levels, such as the rapid test kit for iodine. *(NGOs, research bodies, industry, donors)*
- Use simple, rapid anthropological methods that can become routine for assessing relief or transition situations to select foods for populations. *(Research bodies, NGOs, IOs)*

4. Advocacy

- Document the effectiveness of nutrition interventions, especially fortification of foods, in achieving intended impacts (biological, social, economic productivity, etc.), by analyzing existing data or collecting new data. Use the information for advocacy purposes. In assessing impact, include the provision of target nutrient intakes as a critical intermediate goal. *(Donors, NGOs, academia, research bodies)*
- Further develop advocacy tools specific to relief and transition settings that can be used to convince policy makers of the need for improved nutrition interventions in populations of displaced persons. Use the PROFILES[16] software for advocacy of improved iodine and iron status as a model/starting point. *(Donors, NGOs, governments)*

[16] ***Profiles*** software is developed by the Academy for Educational Development (AED), Washington, DC. Available upon request.

SECTION III: RESEARCH NEEDED

Throughout the workshop, information needs developed into research options. Highlighted were opportunities for industry to explore new products and technologies, and for donors and academia to help field implementers develop monitoring and assessment tools for nutrient deficiencies. Each group working in concert with the others could contribute to improving relief diets. A research coordinating body was suggested to follow up on the workshop recommendations and research ideas. Participants agreed on the utmost importance of ensuring that ethical considerations are respected in research, and that refugees benefit directly from research conducted in emergency settings. (*Donors, research bodies, industry, NGOs, IOs and academia can all contribute to the research agenda.*)

A. General Research

- Develop more "field-friendly" methods for assessing nutrient deficiencies.
- Develop a test kit to determine how much fortificant has been added, such as the quality control "micro-tracers" developed by the food industry.
- Explore new technologies for fortification that preserve added nutrients or reduce interaction of nutrients with foods, (e.g., fat encapsulation of nutrient to protect from losses, nicotinamine-ascorbic complex, and polyphosphate ascorbate).
- Continue to develop and test low-cost fortified complementary foods locally or regionally.
- Conduct cost and feasibility analysis of food aid ration fortification *vs.* using locally available foods to provide the full scope of dietary needs in relief situations.

B. Specific Field Testing

- *Value-added Food Aid*

i. Re-examine information about "instantized" foods examined thirty years ago. Field test the new "instantized" corn soy commodity USDA is preparing to add to foods specifically made for U.S. food assistance. Do field tests in situations where potable water is and is not readily available to ensure the "instantized" product has no adverse impacts.

ii. Develop technology for low-cost, locally palatable, instant, consumer-ready foods and other products (e.g., precooked beans) to diversify the food basket in emergency settings, and provide recipients with more convenient foods.

- *Vitamin C Deficiency*

Clinical vitamin C deficiency (scurvy) remains a problem in some protracted relief situations. Providing vitamin C continues to be difficult in almost all refugee settings because of expense, limited food sources, and instability of the vitamin. To address this problem:

i. Review use of vitamin C-fortified beverages and pilot future trials.
ii. Explore additional food vehicles for fortification with ascorbic acid (vitamin C), such as condiments added after cooking.
iii. Consider all possible methods of increasing access to and use of locally available fresh fruits that provide vitamin C.

- *Condiments*

Including more locally accepted condiments in food baskets was suggested frequently during the meeting. Participants saw this as a way to make the diet more palatable and satisfying, a possible source of additional nutrients, and a vehicle for fortification. Examples mentioned include:

i. Sauces

Develop and field-test sauces fortified with micronutrients. In testing, address how the product should vary from setting to setting. Build on existing sauces such as fish sauce (Asia) and tomato sauces.

ii. Bouillon cubes

Develop and field-test fortified bouillon cubes. Technical specifications exist for fortifying bullion cubes and the product has proven to be acceptable in industrialized countries. Acceptability in refugee situations is not known. If relief agencies can provide the demand (procurement orders), then makers of bouillon should be able to provide the supply.

iii. Other condiments

Review and continue to explore how commonly used condiments (e.g., MSG, sugar, and dried fruits and vegetables) can be fortified and marketed in relief settings.

Conclusion

The workshop built on the achievements of past workshops and meetings among NGOs, donors, and technical experts. Participants shared efforts made over the years to improve the nutritional quality of the relief diet. Some of these efforts (e.g., fortification of blended foods) have been widely used in relief settings, while others (e.g. Sprinkles, fortified condiments, bartering of relief foods) are in the experimentation stage. Resources and technical assistance are urgently needed to accelerate adaptation of new technologies, particularly in fortification and agriculture. Participants concluded that food fortification is one of the best strategies to alleviate micronutrient deficiencies of refugees and displaced persons. The next step is for donors, industry, academics, and development/emergency organizations to move forward with the ideas and recommendations that emerged from the workshop, in order to improve diet diversity and alleviate suffering from nutritional deficiencies in relief populations.

WORKSHOP PROCEEDINGS

History of Efforts to Enhance Quality of Relief Foods

Summary of Malnutrition in Emergencies
Dr. John Mason, Tulane University

Micronutrient deficiencies have always been prevalent and widespread, with real human consequences. The present total goiter rate in children ages 6-11 around the world is a good example. Vitamin A deficiency in children <5 years is also widespread, but mostly in Central Africa. Vitamin A deficiency presents major risks for mortality in children and pregnant women.

Many people suffer from more than one deficiency, especially preschool children (see table below). Addressing the deficiencies one at a time has little effect. An integrated approach is required because of the interactions among various nutrients.

Illustration of Possible Overlap of Micronutrient Deficiencies in Preschool Children, ca. 1995

Region	Percentage with Two or More Micronutrient Deficiencies	
	Prevalence	Estimated Number Affected (Millions)
South Asia	35.6 %	59.5
Sub-Saharan Africa	35.2 %	35.9
Middle East/North Africa	20.0 %	8.6
East Asia/Pacific	18.2 %	29.6
Latin American and Caribbean	19.6 %	10.2
TOTAL	27.3 %	143.8

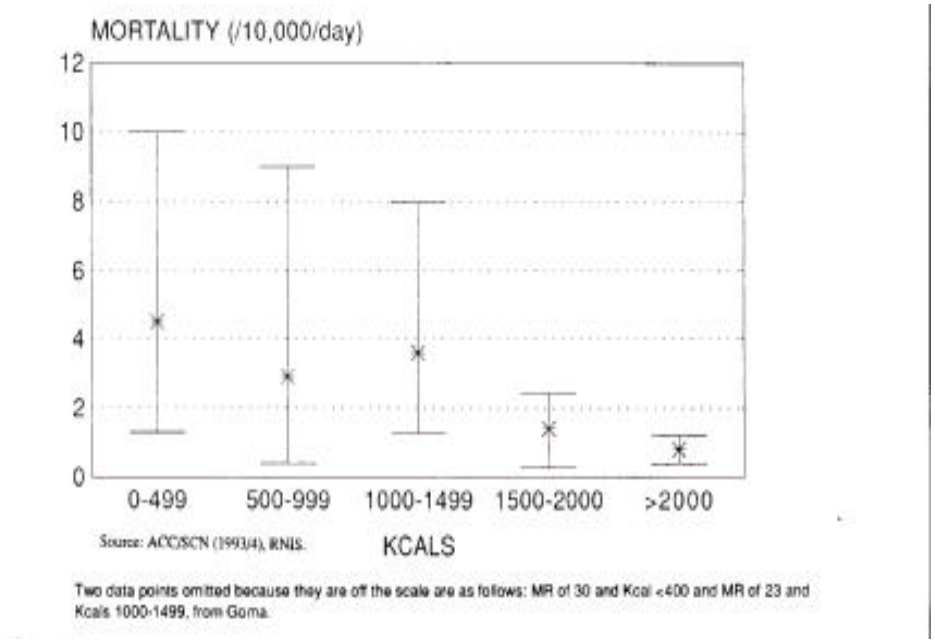
Note: Anemia data: WHO, 1997. Prevalence of Anemia among Different Populations based on national data. Tables from MDIS Working Paper #3. Geneva: WHO. VAD data: UNICEF, MI, Tulane University (1998). Progress in Controlling Vitamin A Deficiency: Ottawa: The Micronutrient Initiative, 36 pp. IDD data: Mason, J.B, K. Sethuraman, A. Gilman, K. Mason, N. Mock, and M. Lotfi), *Progress in Controlling Micronutrient Deficiencies* (in press).

Outbreaks of micronutrient deficiency diseases are common in refugee and displaced populations who are dependent on international emergency food aid. The following deficiency diseases are

particularly prevalent among refugees and displaced persons, and during times of conflict and emergencies:

- ***Vitamin A deficiency*** – endemic in many parts of South Asia, eastern, western and southern Africa
- ***Niacin deficiency (pellagra)*** – outbreaks in refugee and displaced situations in southern Africa (Angola, Malawi, and Zimbabwe)
- ***Thiamine deficiency (beriberi)*** – outbreaks in Djibouti, Nepal, and Thailand
- ***Vitamin C deficiency (scurvy)*** – outbreaks in Ethiopia, Kenya, Somalia, and Sudan
- ***Iron deficiency anemia*** – occurs worldwide and is not unique to refugees, but is one of the most common deficiency diseases in refugee camps
- ***Iodine deficiency*** – found in most regions of the world

Mortality Range, Mean (x), and Kcals Supplied



Micronutrient deficiencies are difficult to deal with in the midst of conflict. Mortality rates are high in refugee camps even after food assistance arrives (see figure above). In the initial stages of a conflict, relief focuses on preventing starvation and protein - energy malnutrition. When refugees are completely dependent on the ration and trading for diversity cannot be ensured, the ration must be designed to meet fully all nutrient requirements.

Six Misconceptions Regarding Refugees and Nutrition

- ***Starving people can eat anything***. Even well-nourished people would fail to thrive on a monotonous diet of wheat, beans, and oil, month in and month out.
- ***Refugees can manage with less.*** In fact, refugees often need more than their normal food requirement if they arrive at camps malnourished, sick, and in need of rehabilitation.
- ***Trading food indicates that people do not need all of the rations.*** If the food basket does not contain fruits and vegetables, some foods may be traded to add variety and necessary nutrients to the diet.
- ***A standard ration is suitable for all populations.*** Requirements vary according to demographic composition, nutritional and health status of the population, activity level the intake is intended to support, environmental temperature, and likely wastage along the chain from supply to consumption.
- ***Energy adequacy means nutritional adequacy***. The diet needs to be adequate in both quantity and quality, meeting requirements for calories, protein, and micronutrients, i.e., vitamins and minerals.

Source: J. Mason and S. Gillespie, *Lancet*, Vol. 340 (Nov. 28, 1992).

A typical ration for a distressed population is intended to provide minimum energy requirements, but often no provision is made for micronutrient content. However, any micronutrient-deficient ration, even one that provides adequate energy, will lead inevitably and predictably to deficiencies, unless people are encouraged to trade some of their ration for fresh fruits and vegetables, or receive full supplementation. The initial design of the relief rations must state explicitly how micronutrient needs are to be met. The ration should contain diverse and palatable foods and address the special needs of weaning-age children.

Analysis of rations given to Rwandan refugees (cereals, oil, beans, oil, blended food, and salt) found that the actual content of the ration generally provided adequate energy, but was grossly deficient in vitamins A and C. The blended foods did not contain not enough iron. The micronutrient content of rations could easily be calculated at the time of distribution; this would predict whether problems would arise.

Much research is needed on the epidemiology, causes, and consequences, especially in maternal mortality, of vitamin A deficiency in complex emergencies. More knowledge is needed about prevention of vitamin C deficiency. Should other commodities be used to prevent this deficiency? What foods should be fortified? How should supplementation be done? Finally, research is needed on prevention of iron deficiency. Should we diversify foods and/or allow trade? Fortify staples and blended foods? If so, how? How can multi-nutrient supplements be used?

Policy and program decisions involved in micronutrient fortification include:

- recognition of the problem, costs, and benefits
- decision to commit resources and pass legislation to ensure commodities are fortified
- making risks explicit
- monitoring supplies and outcomes

Recommendations

- Encourage more diverse and better quality rations, encourage trading, and fortify everything possible. Staples (cereals) could be fortified with iron, zinc, and other micronutrients. Blended foods could be fortified with vitamin A, iron, vitamin C, niacin, and other micronutrients; and oil could be fortified with vitamin A.

- For supplementation of the basic ration, give high doses of vitamin A capsules to children and post-partum mothers and doses of multiple nutrients, including iron, to the rest of the population. This would work best where relief workers have direct contact with the vulnerable populations they are serving.

We need to know what constraints exist and what practices have been successful. We must support crucial research and lobby for crucial policy decisions. The overall goal is to gain momentum to increase interventions to prevent micronutrient deficiencies in distressed populations.

Alleviating Micronutrient Malnutrition in Relief Settings and Overview of Nutrition Standards

Rita Bhatia, UNHCR

Historical Perspective

During the late 1970s, health teams gave little recognition to the importance of nutrition in general and the composition of food rations. Nutrition activities were limited to anthropometric surveys and supplementary feeding by medical staff. The only nutritional guide available was "The Management of Nutritional Emergencies in Large Populations," published by WHO in 1978. This guide recommended 1500-1800 kcal per person per day as a minimum for survival. Micronutrient malnutrition was considered a problem in children under five.

The importance of micronutrient deficiency diseases in refugees and displaced personshas been documented extensively.

- In the early 1980s, when Ethiopians were displaced into Somalia, local medical and nutrition guidelines made some reference to food rations. Nevertheless, these refugees experienced several unpredicted outbreaks of scurvy, which had not been recorded since the 1800s. Adults were affected as well as children. The population's main source of vitamin C was usually camel's milk, but this was unavailable during the fighting. The longer people stayed in the camp, the greater the risk of developing scurvy. Increasing age and pregnancy were other risk factors.
- Due to lack of diversity in the diet, beriberi was reported among rice-eating Cambodian refugees in Thailand in the late 1970s.
- Between 1989 and 1991, a massive outbreak of pellagra occurred in Malawi, affecting at least 18,000 Mozambican refugees, due to a lack of groundnuts, the only source of niacin in this maize-consuming population.

- Most recently, in southern Sudan, 80% of children were found to be malnourished, and even adults were crawling on hands and knees because they were suffering from the effects of scurvy, requiring massive rehabilitation.

Micronutrient Deficiency Diseases in Refugee Populations (1984-1993)

Micronutrient Deficiency Disease	Year	Host country	Country of Origin
Scurvy	1984	Sudan	Ethiopia
	1985	Somalia	Ethiopia
	1989	Ethiopia	Somalia
	1991	Sudan	Ethiopia
	1992	Kenya	Somalia
	1993	Nepal	Bhutan
	1992	Bangladesh	Myanmar
Beriberi	1985	Thailand	Cambodia
	1992	West Africa	Liberia
	1993	Nepal	Bhutan
Pellagra	1989	Malawi	Mozambique
	1993	Nepal	Bhutan
Xerophthalmia	1985	Sudan	Ethiopia
	1988	Ethiopia	Somalia
	1992	Bangladesh	Myanmar
	1993	Kenya	Sudan
	1993	Nepal	Bhutan
Iron Deficiency Anemia	Same as in developing countries		
Iodine	1983	Thailand	Laos
	1992	Indonesia	Vietnam

Source: CDC/UNHCR/SCFUK/MSF/EPICENTRE, 1993

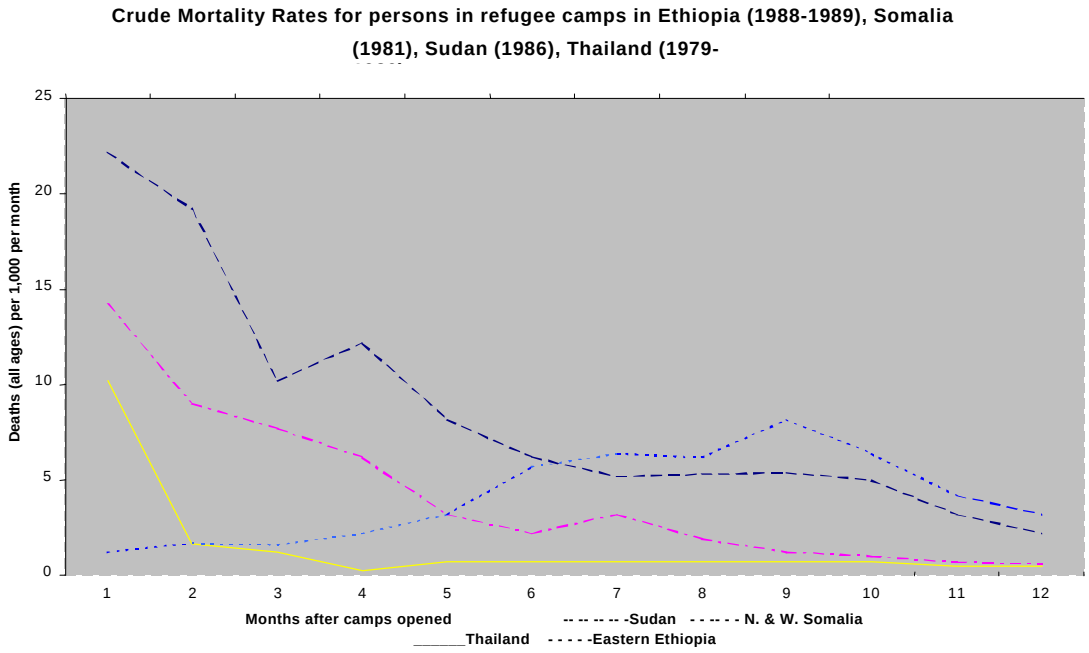
In the late 1980s, the recommended minimum daily ration for refugees was increased to 1500-1900 kcal per day and the discussions about quality of the ration were focused on micronutrient intake. Since the mid-1990s, diversification of diet and free access to local food markets have been recognized as essential for the provision of micronutrients. There has been some progress on fortification of food aid commodities. Supplementation has been tried using pills or orange concentrate drinks, but except for vitamin A, these interventions have not been very successful in alleviating micronutrient deficiencies. Supply of fresh food items through home gardens and trading has developed little. In some cases, refugees are not allowed out of camps to diversify diets by trading, foraging, or growing food crops.

Lessons learned between 1976 and 1999

- Food aid-dependent populations are at high risk for micronutrient deficiency diseases.
- Acute malnutrition prevalence is directly related to mortality rates.
- Standard survey methods, measurement indices, references, and definitions of acute malnutrition among children are needed.
- Nutritional status is related to the incidence of diarrhea, measles, and other communicable diseases whose prevention is an integral part of a nutrition program.

Mortality Rates

Lowering mortality rates in refugee camps takes a long time (see figure below). Logistics and political commitment are part of the solution, but there is no magic bullet because not everyone needs the same thing. The causes of malnutrition presented in the UNICEF Conceptual Framework – lack of resources, insufficient access to food, mother and child care, poor water, etc. – are equally relevant to emergency situations (see Appendix D).



Source: CDC MMWR Vol. 41/No. RR-13

Policy and Standards

The UN currently recommends including fortified blended cereals as part of a ration for populations fully dependent on food aid. Below are key indicators for a full ration:

- *2,100 kcal per person per day*
- *10%-12% of total energy provided by protein*
- *17% of energy provided from fat*
- *Adequate micronutrients from fresh or fortified foods*

Source: "The Sphere Project Humanitarian Charter and Minimum Standards in Disaster Response," adapted from WHO, *Management of Malnutrition in Emergencies* (1977) and WFP/UNHCR *Joint Guidelines for Estimating Food and Nutritional Needs in Emergencies* (1997).

WFP/UNHCR policy on fortification of oil with vitamins A and D and provision of iodized salt has been accepted by several donors. In addition, WHO, WFP, and UNHCR have identified the following nutritional requirements for refugees in the initial phase of an emergency:

Vitamin A	1666 IU (or 0.5 mg RE)
Thiamine (B1)	0.9 mg (or 0.4 mg/1000 kcal)
Riboflavin (B2)	1.4 mg (or 6.6 mg/1000 kcal)
Niacin (B3)	12.0 mg (or 6.6 mg/1000 kcal)
Vitamin C	28.0 mg
Vitamin D	3.2 – 3.8 µg calciferol
Iron	22 mg (low bioavailability 5-9%)
Iodine	150 µg

No ideal option exists for improving the nutrient quality of relief diets, and choices may vary according to the situation. Fortified blended foods have long been used as complementary foods for malnourished children. Adults would consume more of such foods if they understood the benefits. Staple flour can be a good option for fortification, but this is difficult in a large population and the flour's shelf life is limited. Fortified condiments and salt are other options, if they can be made acceptable and palatable. Fresh products, when available, are yet another option.

Current operational issues include:

- the need for "field friendly" methods to diagnose micronutrient deficiencies
- containerized milling unit and fortification at the field level
- distribution of iron cooking pots and education about their impact
- prevention of vitamin C deficiency in food aid-dependent populations, especially in the Horn of Africa
- management of anemia among severely malnourished children
- assessment and management of acute malnutrition in adolescents and adults
- training and capacity building in nutrition assessment, planning, and management of micronutrient deficiency intervention programs
- challenges of data collection under insecure conditions
- better communication, information sharing and program documentation among the donor community and its partners
- HIV and infant feeding

Several general guidelines have been published and widely distributed:
* MSF Nutrition Guidelines (1995)
* WFP/UNHCR Guidelines for Estimating Food and Nutritional Needs in Emergencies (December 1997)
* UNHCR/WFP Guidelines for Selective Feeding Programs in Emergency Situations (February 1999)
* SPHERE Project: Humanitarian Charter and Minimum Standards in Disaster Response (First Edition, 1998)

Specific guidelines are also available on recommended iodine levels in salt, iron supplements, vitamin A supplements, vitamin C fortification of food aid commodities, energy requirements, and cereal-based foods.

The emergency aid community has come a long way in its thinking over the past three decades; however, nutritionists and planners still face significant challenges to alleviating malnutrition in relief settings.

Analysis of Major Programmatic Options to Address Nutritional Deficiencies in Emergency Operations
Dr. George Beaton, University of Toronto

A refugee is a person who flees to a place of presumed safety. Once in a camp, refugees are totally dependent. They have lost everything and food is only one of many needs. Inadequate water, sanitation, housing, and diet all contribute to appalling excess mortality in the initial phases of a crisis situation. People who are acutely ill need diagnosis, treatment, and facilities. Two other important needs of all refugees are hope and self-respect.

Refugee populations go through several phases: initiation (first three to six months), establishment (six months to two years), protracted refugee operation, settlement/resettlement, and finally, development. The first stages are the most critical in terms of the food situation. Food supplies and potential nutrient quality change over time. In the very beginning, people may be absorbed into the local population, so relief workers may be concerned with assisting the host households and not with nutrient inadequacies. People are often unhealthy when they arrive and may have been under stress for a long time. They bring long-term problems with them. Diet in the refugees' home setting is likely to have had marginal inadequacies, so they may be nutritionally depleted but not clinically deficient at entry. After the initial camp period of total dependency, when refugees are often at high risk, they start organizing themselves, and problems diminish. Except in totally closed camps, the diet gradually becomes diversified through barter and other means. This is likely to reduce, but perhaps not eliminate, nutrient inadequacies of the emergency diet.

What should be done to ensure the health of refugees? Clearly the best solutions would be to:
- change human behavior and avoid political refugees
- empower refugees to find their own solutions
- diversify the diet and provide access to customary foods

What could be done to improve the nutritional situation? Since the above options often are not feasible, nutrients might be added to refugee's intake through:

- pharmaceutical supplements
- fortified foods
- purposeful, planned fortification of the staple cereal

Past experience warrants consideration:

Past Activities

Actions	***Limitations***
Provide free market access to local foods	Availability of cash and foods
Purchase and distribute preferred foods	Availability and perishability
Use donated foods	Acceptability, nutrient adequacy
Use donated foods + supplements	Distribution logistics
Use fortified donated staples	Opportunity, composition
Use donated foods + barter for preferred local foods	Unreliability of system

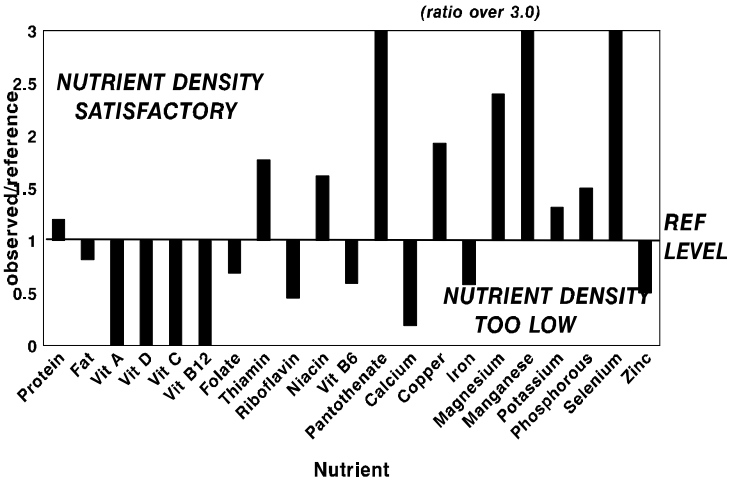
Targets and goals:
A number of past errors need to be avoided in future. It is an error to target only young children. The target is the whole population, including parents. This has been a major mis-definition of the problem, often encouraged by nutritionists. It is also an error to target only nutrients presenting clinical manifestations of the deficiency, and an error to focus only on a few nutrients. This is illustrated in the figure on the next page, which compares the WFP/UNHCR basic refugee ration made available in Africa in the early 1990's with a reference pattern of per caput needs to address the total, mixed population of men, women, girls, and boys–the family groups or household members that represent consumption units. In the early months of many of the African refugee influxes, even the basic ration could not be supplied in full, so the portrayal may be very optimistic. The major feature to note are the multiple nutrient shortfalls. It makes little sense to plan for uni-nutrient supplementation or fortification. It is not just those few nutrient deficiencies that present as classical scurvy, pellagra, or xeropthalmia that must be addressed. The others influence health, though perhaps not so dramatically; they too must be addressed.

"It is an error to target only nutrients presenting clinical manifestations of the deficiency, and an error to focus only on a few nutrients."

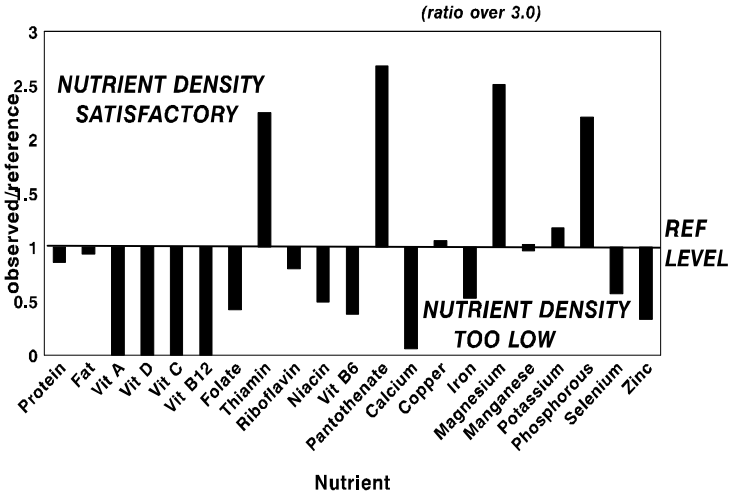
If the logistics for either direct supplementation or fortification approaches can be resolved, the opportunity should be taken to address the full spectrum of shortfalls. Finally, it is an error to assume all fortified foods are the same and that a fortified food, any fortified food, is the solution. To be effective, fortification must be designed to meet specified needs, and fortified foods must be used in specified ways. Perhaps a major error of the past has been the failure to recognize this or to match field usage and manufacturing design in the often very expensive blended foods. The goal is to provide sufficient acceptable, safe, and nutritious food to the whole population.

NUTRITIONAL QUALITY OF REFUGEE DIETS

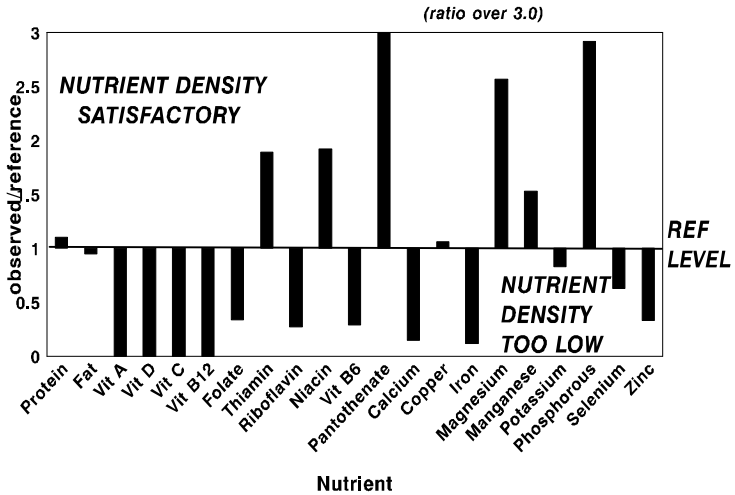
WHEAT-BASED RATION



MAIZE-BASED RATION



SORGHUM-BASED RATION



This may involve several distinct approaches. Direct capsule supplementation is seldom a viable way to control micronutrient inadequacies. Diet diversification, while highly desirable from the standpoints of human values and improved nutrient supply, is seldom equally available to all people; some can access other foods but many cannot, and even this may change over time. Food fortification seems to be the most viable solution, but feasibility is a real problem. The issues include when to fortify, with what, how to do it, and how much of individual nutrients to add.

The first months of a new camp are critical. Relief workers have to mobilize quickly but adequate organizational structures may not yet be in place. It is important that we not be destructively critical, but rather that we work together to collectively improve the system.

Practical Approaches and Methods to Meet Nutritional Adequacy
Dr. Michael Golden, University of Aberdeen, Scotland

Type I and Type II Deficiencies

The body can respond in two different ways to the lack of a nutrient. It is important to differentiate these responses and the nutrient deficiencies that provoke one response or the other.

The first response, Type I, is to keep growing and use up the nutrient stored in the body, at which point the specific metabolic function that depends on the nutrient declines and the person becomes ill. The illness has characteristic signs and symptoms, so the deficient nutrient can be identified and remedied. Examples of some Type I nutrients are iron, ascorbic acid, and vitamin A.

The alternative response, Type II, is for the body to stop growing or repairing tissue in order to conserve the nutrient in the body, or even break down its own tissues to make the nutrient available to the body. Other Type II nutrients are lost in the process, and since these nutrients are found in similar concentrations in many foods, it is not uncommon for diets to be deficient in several Type II nutrients at once. However, it is almost impossible to determine which nutrient is causing the growth failure. Examples of Type II nutrients are potassium, magnesium, zinc, and protein. Deficiency in any of these nutrients leads to reduction of appetite and this is why weight is lost. No characteristic signs or symptoms differentiate one Type II nutrient deficiency from another. The lack of growth or weight loss is often ascribed to toxins, infection, worms, persistent diarrhea, or another pathological agent.

Characteristics of the Different Types of Nutritional Deficiencies

Type I	Type II
Tissue level variable	Tissue level fixed
Use in specific pathways	Ubiquitous use
Characteristic physical signs	No characteristic signs
Late or no growth response	Immediate growth response
Storage in body	No body store
Buffered response	Response to daily input
No interdependence	Control of each other's balance
Little excretory control	Sensitive physiological control

During catch-up growth, all the Type II nutrients have to be given in the correct balance and in much larger amounts than the RDAs for normal growth or body maintenance –sometimes ten times as much. Not only the nutrient that was deficient in the initial diet needs to be given in increased amounts. Some nutrients, such as protein, need adequate zinc, phosphorus, magnesium, or potassium in order to be absorbed. It might be cheaper to lower the protein content and increase other Type II nutrients to ensure a complete balance, especially when considering fortification of blended foods.

"It might be cheaper to lower the protein content and increase other nutrients to ensure a complete balance. . .of blended foods."

Dietary Requirements: Disease and Health

Good nutrition creates positive health. The process of converting nutrients determines human development and body composition, modulates and controls body functions, and enables the body to resist disease. Stress is high in refugee camps, due to unsanitary housing and lack of shelter, dirty water, malaria, arduous fieldwork, and extremes of heat and cold. Stress robs the body of nutrients, so to protect the immune system, refugees need increased amounts of nutrients necessary just to prevent clinical deficiency disease. RDAs for normal healthy populations are already insufficient to ensure optimal health in refugees, yet they receive less.

Strategies to Increase Intake: Pros and Cons

- Giving supplementary food to the whole population may work for Type I micronutrients. However, the level of Type II nutrients (e.g., potassium and magnesium) needed for rehabilitation makes the food item unpalatable and it may not be eaten by some of the population.
- Fortifying a staple food item requires the item to be milled. Milling has to be done close to the refugees, not in industrialized countries. Cereal grain is less attractive than the pulse. The pulse is less bulky and small mill capacity is more likely to cope. The pulse has a very long cooking time and the undercooked pulse is toxic. Milling reduced the cooking time.
- Using traditional "fortification" methods, such as germination, fermentation, and adding plant ash to the food, should be encouraged.

Use of Tailored Diets to Treat Nutritionally Deficient Children: Successes and Failures

Therapeutic feeding: If the nutritional balance is right, children put on weight rapidly, sometimes at the rate of 15 grams/kilo/day, which is 20 times the normal rate. They catch up in height as well as weight, and the rapid "convalescence" reduces their risk of infections. However, the growth rate drops off when the children are given porridge or blended foods that are nutritionally unbalanced.

Supplementary feeding: In supplementary feeding programs studied, 75% to 80% of children gained weight at a rate of 0.5 to 2.5 g/kg/day; however, 9% gained no weight and 15% lost weight. Most troubling was a 22% rate of abandonment of the program, due to lack of noticeable rehabilitation of children.

We cannot have a double standard about nutritional requirements. Refugees have the same metabolism as everyone else. We should start with Western standards and extrapolate from those.

When this concept was applied in Rwanda, using a pre-cooked porridge based on oats, soya, and a mineral/vitamin mix, children's weight gain improved immediately, from about 1 to about 4 g/kg/day. More important, the number of children abandoning the program fell dramatically.

Another sensible strategy is to take the staple food of the culture and add the sauce the people usually eat. When fortified sauce was given to Saharawi refugees in southern Algeria, children gained weight and height at an accelerated rate, and severe anemia was eliminated from the study population. Attention was paid to all 40 essential nutrients, including the "forgotten nutrients" – magnesium, potassium, phosphorus, etc.

Innovative Strategies to Improve Diets

A broad portfolio of nutritional strategies is needed for the whole population, not just children and pregnant women. Soaked and germinated beans are a good source of vitamin C. The difficulty is finding viable beans without weevil holes. Another alternative is to distribute seeds of fast-growing, green leafy vegetables for micro-gardening. We can include spices and herbs in the food basket and encourage bartering. We should ask anthropologists for ideas, not just economists.

General Nutrition Principles to Improve Diets and Food Relief to Refugees

1. A varied diet is most likely to give all the nutrients in the right balance and ensure intake of nutrients for which there is no RDA (e.g., polyphenols, flavonoids). Such a diet reduces both the intake of any toxins contained in one component and the concentration of anti-nutrients (nutrients that interfere with the absorption of other nutrients). Most important, it is not monotonous, tedious, demeaning, or humiliating.

2. Reliance on one dietary item for an essential nutrient is dangerous unless everyone takes it. Some members of a population may not like it, some may trade it for other food, and some taboos or traditions about the item may exist in some populations.

3. Reliance on a minor item of the diet with a high concentration of the nutrient to compensate for a deficiency in the rest of the diet is dangerous. Some people will take an excess of the minor item, and others will not take enough. Most nutrients are toxic in excess to some people (e.g., vitamin A during pregnancy or sodium for persons with hypertension).

4. Fermentation, germination, and fortification are all traditional ways of preparing food that should be encouraged in relief situations. They are sustainable, cheap, and readily available. For example, Hopi Indians fortify maize with ashes from the cooking fire, which adds magnesium, potassium, zinc, copper, iron, and selenium. Asian cultures ferment soya beans to make tofu or sprout them. Many Africans, Amerindians, and Pacific Islanders ferment foods, thereby increasing availability of minerals and synthesizing vitamins.

"Fermentation, germination, and fortification are all traditional ways of preparing food that should be encouraged in relief situations. They are sustainable, cheap, and readily available."

Not enough is known about dietary requirements in hostile environments, the amounts of nutrients required for the body to resist disease, or the nature and extent of pre-existing deficiencies of most of the 40 essential nutrients in destitute populations. Diets seem to be designed by consensus, with no follow-up to see whether refugees are nourished and growing. We need to invest in routine

data collection and analysis to monitor weight, the rate of abandonment of programs, and what is actually happening at the field and beneficiary level.

"Seeds of Hope", USAID/Office for Foreign Disaster Assistance funded project run by World Vision International in Rwanda. (photo by J. Fox)

P.L. 480 Title II Food Aid: An Overview of Issues and Progress in Enhancing Program Foods
Dr. Tom Marchione, USAID/BHR/PPE

USAID is the largest food donor in the world. Over one third of all FY 1997 P.L. 480[17] Title II food aid, or 590,000 metric tons worth $183 million, consisted of micronutrient-fortified, blended cereals. Now 100,000 metric tons of vegetable oil fortified with vitamin A have been added. These foods reach about 20 million persons in emergency situations each year. However, international food aid alone cannot solve the problem of lack of quality diets. USAID wants to find alternatives and complements to food aid to meet the micronutrient needs of refugees and IDPs.

"International food aid alone cannot solve the problem of lack of quality diets. USAID wants to find alternatives and complements to food aid to meet the micronutrient needs of refugees and IDPs."

The adequacy of one nutrient, vitamin C, is of particular concern in relief situations. In 1997, the National Academy of Sciences (NAS) concluded that under

[17] PL480 or US Public Law 480 – United States government legislation that authorizes food assistance programs to low-income, food deficit countries.

current conditions, adding more vitamin C to food aid was not a cost-effective means of delivering the vitamin in refugee situations, for the following reasons:

- The extent of the vitamin C deficiency is relatively localized in space and time, for example, the Horn of Africa in the late 1980s. More vitamin C in all food aid for all people does not make sense.
- Vitamin C-bearing food was particularly absent when scurvy was observed in the Horn of Africa. Adding the vitamin C makes no difference if the fortified food aid is not reaching the people.
- The uniformity of the vitamin throughout a production lot of fortified cereal foods was poor at U.S. processing plants, so a batch of supposedly fortified food might not have sufficient vitamin when shipped.
- Large amounts of the vitamin are lost in food preparation.
- The trade-off between quality improvement and quantity of food is too high. Doubling vitamin C would deny rations to nearly half a million refugees or internally displaced persons for one year.

The uniformity and stability of vitamin A in processed U.S. food aid raises similar concerns. A SUSTAIN report commissioned by USAID on this subject is about to be released[18]. USAID accepted the NAS recommendation not to increase the vitamin C level in its commodities.

Three other recommendations were to:

- Strengthen surveillance systems in refugee camps to initiate more timely responses.
- Target identified populations at risk for scurvy with appropriate vitamin C interventions, including increased access to local foods and markets and/or local fortification of commodities in the country or region where the emergency is occurring.
- Use vitamin C supplementation.

Other shortcomings of international food aid are well known, such as its lack of timeliness in reaching affected groups and inflexible policies regarding the trading of food by recipients for other necessities that are equally as pressing as food needs.

USAID and the U.S. Department of Agriculture are trying to enhance refugee diets by:

- Fortifying foods in which micronutrients are more likely to be uniformly distributed and are more stable, such as the recent addition of vitamin A (retinol palmitate) to vegetable oil. USDA is working on new forms of micronutrient-enriched extruded blended foods.
- Improving regulations governing the production of processed foods
- Recommending improved processing technologies to U.S. food processors that supply food aid
- Improving the commodity mix provided in refugee situations to include more balanced rations. A look at the most recent array of foods provided shows greater use of vitamin A-fortified products for emergency situations.
- Improving reporting on emergency situations through enhancement of the Refugee Nutrition Information System (RNIS) of the ACC/SCN
- Rewriting the Commodity Reference Guide with guidelines for designing rations in emergencies (website: info.usaid.gov/hum_response/crg/)

[18] *Micronutrient Assessment Project Final Report*. SUSTAIN. September 1999.

Desired outputs from this conference

- Feasible methods to enhance refugee diets that are initiated close to the refugees. This is where reliable, timely, and sustainable solutions will be found not only for dealing with crisis, but also for transition out of crisis and back into development.
- Ideas on how local efforts might be complemented by the uses and composition of international food aid

Recommendations for discussions

- Keep a sense of proportion between quantity and quality of food, between food and other needs of refugees, and about the importance of micro- and macro-nutrients. In an environment of shrinking resources, we are sometimes playing a zero sum game. Improving quality can reduce quantity, while improving diet might sacrifice other needs.
- Avoid medicalization and too much reliance on capsule supplementation. Resist the trend to substitute livelihood- and food-based approaches with chemical-based (pharmaceutical) approaches.
- Expert knowledge is not enough. Trust local knowledge. Refugees have capacities, skills, and knowledge from which local programs can be scaled up.
- Fortification is more difficult than it looks. Ensuring a level of micronutrients in fortified food is difficult even under the best of circumstances.

* * * * * * *

Discussion Section - Main Points

- Information needs, basis for action, data for decision making: Getting information on the refugee population's physical status, diet, and micronutrient deficiencies for a baseline is difficult, yet sharing of data is critical. Perhaps the best way to begin is to assume most refugee populations are deficient and give them all the nutrients.
- Temporary responses: Dropping food by helicopters is an immediate solution to stranded populations; smoothing out resource commitments takes a more long-term view. The best thing is to find ways to support livelihood security (ability to secure populations' means of providing basic needs for themselves and their families) and get people back to work if possible.
- Refugees *vs.* IDPs *vs.* local populations: Many believe that refugees are better off than local populations, who might pretend to be refugees to get access to food aid. Depending on the nutritional state of the local host population, services may have to be put in place for both locals and refugees. When populations are integrated, those in camps also have access to some local production and foods.
- Internally displaced populations have special needs: Many have been forced into marginal areas without crossing borders, while others arrive in camps having already been internally displaced for a long time.
- Complexity and sustainability: Food aid has to address issues of severe malnutrition, general rations, and income support. A complex response is needed to move a refugee from dependence on food aid to sustainable livelihood security.

* * * * * * *

General Introduction to Food Fortification in Relief, Drought, and Transition Situations
Dr. George Beaton, University of Toronto, Canada

Fortification is a potential solution to micronutrient inadequacies in relief situations. However, the food to be fortified must be processed, and that imposes serious constraints. In 1994, WFP reported that about 75 % of their cereal grains were being distributed in unmilled form; very little information was available about how the recipients actually prepared the grain for cooking and consumption, or hence about opportunities for fortification after distribution. Little information was available about milling and fortification capacity in Africa at that time. Much more is known today and WFP reports that it is progressively increasing the proportion of cereals that are milled prior to distribution. An important constraint to fortification is thus being relieved, but to grasp this new opportunity, we need innovative approaches. Depending on the situation, we might consider fortification at a large-scale milling facility, at a somewhat smaller regional mill, at a still lower-capacity mill at the point of distribution, at very small batch mills within camps, or even at the level of food preparation or serving (see discussion of "Sprinkles"). Some of these options will be discussed later in this report.

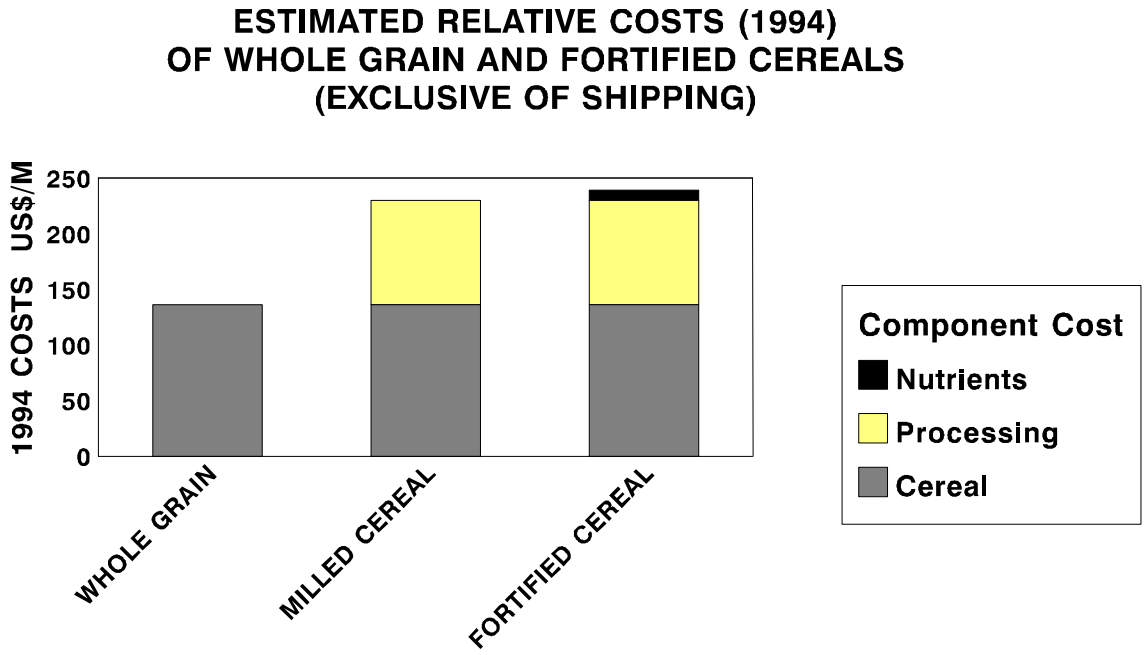
Before going further, we must address the recurring issue of costs. In this meeting and in the literature, one hears statements that fortification costs are insignificant, that fortification costs are prohibitively high, and that to improve significantly the nutritional quality of rations means feeding many fewer people. *Both these assertions may be true depending on context.* This can be illustrated with cost estimates generated in 1995.

Using data drawn from USAID and CIDA billings and from information provided by a supplier of micronutrients, the following very crude estimates of costs per metric ton were generated. Cost of whole grain cereal – US$ 136.40; cost of milling – US$ 66.50; additional value-added costs, presumably including both handling and quality control charges – US$ 27; cost of added micronutrients – US$ 9.40. The nutrients to be added were based on an evaluation of shortfalls in the then-available WFP/UNHCR ration in Africa (see figures in earlier talk by Beaton)]). The package of nutrients is more comprehensive than those usually discussed at this meeting, but comparable perhaps to the sort of package Dr. Golden would suggest. The nutrients needed to meet normative requirement estimates (sufficient to meet functional needs and support generation and maintenance of stores in normal people) were costed, and the nutrients needed to meet basal needs (sufficient to support recognized function but not to generate normative stores) were costed. The difference in cost for nutrients at these two levels was only $1.9 per MT of fortified cereal (25% of the cost of nutrients but only 0.8% of the cost of the final product.

The bar diagram below portrays these costs in a way that brings out the essential point. The cost of fortified maize is about 75% higher than the cost of unmilled corn. *It follows that if a country operating on a fixed food aid budget were asked to supply fortified maize rather than whole grain cereal, the tonnage, and hence number of people fed, would be decreased by about 57% –a little more than half.* At first sight, this is a powerful argument against fortification. However, look at the bar chart again. *If WFP and UNHCR were able to meet their policy to distribute milled rather than whole grain cereal, the additional cost of fortifying it at the time of milling is only 4% of the total cost of the fortified cereal.* This cost is still significant, but nothing like the cost of milling and handling the cereal.

"The very real issue in costing the fortification approach is not the cost of nutrient addition but the cost of milling the cereal."

The very real issue in costing the fortification approach is not the cost of nutrient addition but the cost of milling the cereal. This was WFP's



If fortified only to basal requirement level, nutrient cost falls from $9.4 to $7.5 per MT (Cost estimates based on USAID and CIDA billings)

Based on Beaton, 1995

problem in 1994. Its policy was to distribute milled cereals wherever possible (or increase the cereal ration to allow for milling losses/costs where pre-distribution milling was not feasible). WFP reported that it did not have available monetary resources or donations to meet the cost of milling. Many donors preferred to give commodities rather than cash, an approach that benefited the donors' agro-industries as well as the ultimate recipients. The only solution available was to distribute whole grain cereal and, in effect, pass the cost of milling on to the refugees. That should be a concern to all of us, particularly in the early phases of refugee migration. I put it to you that we must focus more attention on both developing facilities for milling cereals (or other commodities) before distribution and meeting these costs. This, I suggest is a moral obligation we must attempt to meet. If we do, then there is opportunity to implement the fortification solution. Without provision of facilities and necessary operating costs for milling, fortification is not a feasible solution. However, it should be stressed that the milling costs must not be written off as a cost of fortification. They are a cost associated with provision of usable food to refugees.

The waters become very blurred when we speak of preparing special purpose foods for treatment and rehabilitation of malnourished individuals. Here, we have to consider more than micronutrient additions (see work of Dr.Golden and Action International Contra la Faim (AICF). The costs become very high indeed, but what is being acquired is a "complete food mix" for very special purpose feeding. To use such foods as a vehicle for supplying nutrients to the general refugee population becomes a very expensive approach.

Another issue to be addressed in designing fortification approaches is nutrient needs. If the target is the total population (men, women, children = "households"), then we must recognize that these classes of individuals have different nutrient needs. It is reasonable to assume that in the initial

stages of emergency feeding, at least, the members of a household unit share the same food and that total food intake (as energy content) is reasonably equitable in proportion to actual energy needs (provided that enough food is made available to meet at least basic energy needs). Nutrient intake and distribution among household members would then be expected to be proportional to their total food/energy intake, not necessarily proportional to their nutrient needs.

How then to decide on level of fortification? The solution I applied, and strongly recommend, was to develop a profile of nutrient density needs (nutrient concentration per 1000 kcal at which it would be expected that the nutrient needs of almost all individuals in the class would be met when energy needs/requirements were met). This was done for each nutrient for each class of individual, and a household nutrient density profile was then developed by selecting, for each nutrient, the highest density needed for any class. This process then yielded a reference nutrient density profile which served as a target. The composition of rations could then be compared to this profile, the shortfalls identified (see figures on page 26), and the fortification needs worked out. Contrast this approach with that of most discussions in the literature, which assume that a particular commodity will be consumed in specified amount by specified individuals; usually this is not credible except in the situation of controlled feeding (e.g., in treatment and rehabilitation centers). In turn, this leads to the need to define the intended use of a fortified commodity and to marry the design of fortified foods with their actual usage.

Likely we will hear much more about these issues during the meeting, and they will have to rise to prominence when we truly become serious about addressing the needs of refugees. The answer will have to lie in a collaborative, harmonized approach, not in multiple specialized products used indiscriminately as they become available.

"These issues (of fortification of relief foods). . .will rise to prominence when we truly become serious about addressing the needs of refugees. The answer will have to lie in a collaborative, harmonized approach not in multiple specialized products used indiscriminately as they become available."

Comparing Options for Getting Micronutrients to Relief Populations
Dr. Willem Wurdemann, Royal Tropical Institute (KIT), The Netherlands

There are two main options for improvement in micronutrient nutrition. One is diversification of the diet or food basket with foods naturally rich in micronutrients, and the other is fortification of processed foods. The first option is preferable in societies with limited consumption of processed foods. The second option is more suitable for emergency situations and allows specific targeting.

Two Examples of Fortification of Processed Foods

KIT has been involved in local production of fortified blended foods in various countries since 1982. These donor-funded programs combine nutrition/food aid with structural economic development. The latter is probably more important in terms of sustainability. Production is small scale and the fortified blended foods are used to feed vulnerable groups, small children, and pregnant women. Foods are also commercially marketed through local channels. Making the food product accessible to the larger population is a preventive approach to malnutrition. The profits from sale of fortified foods are used to develop local production and markets.

KIT has assisted in the establishment of production units in:

- Ghana (Vitalmix and Nutrimix – 2 units) since 1987-1988
- Niger (Bitamin – 1 unit) since 1991
- Benin (Farine de Ouando – 1 unit) since 1985
- Burundi (Musalac – 1-5 units) since 1987
- Malawi (*Likuni Phala* – 4 units) since 1991-1992

Products are blends of cereals, grains, legumes, and oil seeds, for example, 80% maize and 20% soya. A wide variety of commodities can be used, including local ones. The processing is done by roasting and milling. Processed food is packaged in bulk for food aid or in small packages for retail sales.

Initially, blended foods were not micronutrient fortified for several reasons: because it was believed that food aid recipients did not need micronutrients, because CODEX[19] did not require fortification, and because the simple technology had not been researched and tested. In addition donors were not requesting fortified foods because the emphasis at that time was instead on protein - energy malnutrition and child nutrition (complementary feeding practices).

In 1989, KIT started micronutrient fortification of Musalac in Burundi, and in 1994, fortification of Likuni Phala in Malawi. Since 1988, the units in Malawi have been receiving technical assistance from SUSTAIN through their African Microenterprise Small Enterprise Activity program.

The technology is simple, using small motor-driven batch mixers modeled after a simple concrete mixer. Fortification is done with UNIMIX premixes (a multinutrient mix-see box below). A good alternative to this method would be a volumetric feeder and dosifier on a hammermill because it would be more efficient and monitors units in a controlled environment. However, no appropriate hardware is available as yet. SUSTAIN, World Vision International/Malawi, and local machine manufacturers are collaborating to develop the hardware. In larger commercial plants, batch mixing or volumetric feeders are used.

Quality Control and Assurance

The small production unit is possibly the smallest scale where effective quality assurance is practically feasible. From our experience, it is not feasible to monitor effectively under village conditions. In Malawi, the production units are monitored by the Malawi Bureau of Standards and staff are trained to pay attention to quality assurance. Mixing results can be checked by adding a small dose of blue detergent powder as a tracer. Of course, the sample mixture is then not for consumption.

Composition of Fortificant Premixes

Roche of Switzerland developed standardized micronutrient concentrates in the 1990s at WFP's request, under the name UNIMIX. These concentrates are easy to order and are relatively inexpensive, and the final product is of uniform quality and composition, even if from diverse processors or suppliers. The disadvantages are that they are not able to

[19] Codex Alimentarius is an international code of food standards, guidelines and principles developed by an international commission established in 1962 by FAO and WHO. Since its establishment, the Codex Alimentarius Commission has completed 28 volumes of commodity standards and hygienic and technological practice codes, published by FAO.

address specific nutritional situations and can sometimes be more costly than what is required.

Composition of UNIMIX for WFP's Likuni Phala

Roche IS-218 (Unimix Vit)		ROCHE IS-219 (Unimix-Min)	
Premix dosage – 1 kg per MT		Premix dosage – 3 kg per MT	
Nutrients/100 g flour (roasted/pre-cooked)		Nutrients/100 g flour	
Vitamin A	1665 IU (=500 RE)	Iron	8.0 mg
Vitamin C	48.0 mg	Zinc	5.0 mg
Vitamin B1	0.128 mg	Calcium	100 mg
Vitamin B2	0.448 mg		
Vitamin B12	1.2 mcg		
Folic acid	0.06 mg		
Nicotinamide	4.8 mg		

Fortification costs in Malawi, using vitamin and mineral Unimixes, per metric ton, are as follows:

UNIMIX vitamin premix	1 kg at US$18.80	US$18.80
UNIMIX mineral premix	3 kg at US$6.42	19.26
Freight approx. for 200 kg shipment		9.77
Total		US$47.83

The cost per kilo of fortified flour is US$0.0478 (MKw2.15[2]). The cost of one kilo of *Likuni Phala* is approximately US$0.40 (MKw 18.00) and the cost of one kilo of maize flour is about US$0.18 (MKw 8.00). Cost of fortification is about 10% of total cost per kg of flour. Just for maize flour, the price goes up 25%. These are costs that may be transferred to the consumer.

Fortification of Maize Flour for Refugee Feeding in Malawi

In the 1990s, Mozambican refugees in Malawi received a food basket of maize flour, vegetable oil, pigeon peas, and groundnuts through WFP. Maize was purchased locally, when possible, and milled by local millers. In early 1990, there was an outbreak of pellagra, which was attributed to shortages in groundnuts. WFP, UNHCR, and Save the Children UK agreed to replace the groundnuts with fortified maize meal. Volumetric feeding equipment was selected and arrived in August 1991, a year and a half after the problem had been noted. The fortified maize meal contained 4.5 mg nicotinamide, 0.3 mg riboflavin, and 0.5 mg thiamin per 100 grams. Fortification was monitored by measuring riboflavin with a fluorescent detector.

A number of problems had to be solved. The local people use very fine flour, but the only way to fortify was to use coarse flour, which people washed in the preparation of the porridge, leading to losses in water soluble B vitamins. This problem was solved using batch premixing with coarse flour, followed by continuous final mixing. The complexity of introducing fortification in the local industry was underestimated, resulting in long start-up delays. The pellagra outbreak was almost over by the time fortification began. The technology was probably too complicated. Batch mixing as used in animal feed production is cheaper, simpler, and more flexible. In conclusion, selective fortification could play a useful role in alleviating a specific nutritional problem, but in

[2] MKw is the monetary currency in Malawi.

this case finding groundnuts may have been a better solution. Fortified maize meal should not be relied upon to supply refugees with all nutritional requirements at the expense of a normal varied diet.

this case finding groundnuts may have been a better solution. Fortified maize meal should not be relied upon to supply refugees with all nutritional requirements at the expense of a normal varied diet.

Lessons Learned

- Blended foods can be a good way to address specific nutritional problems, e.g., in small children and other vulnerable groups, although sharing within the household can be a problem.
- Preference should go to supporting local production, as a stepping stone away from the emergency situation.
- Local production should be done not as charity, but as a business.
- Small production units are the lowest levels that can be controlled.
- Fortification at village level is worth looking at, although there are still
- Problems with logistics, quality control, and differences in fortification at refugee camps (controlled environment) and at village level

* * * * * * * *

Discussion Section - Main Points

- A few studies have been done on the impact of blended foods on children, but it is difficult to organize such studies without control groups. Also, many other variables, such as the overall health situation, make it very complicated. Data from Malawi and from USAID can be made available through SUSTAIN or USAID Global Programs.
- When people are displaced and a balanced diet is not available, it is vital to stick to the issues and not get involved in policy struggles. In Malawi in 1989, with its huge refugee population, it was predicted that without groundnuts there would be a major pellagra outbreak. The issues were the time frame required to respond and the food vehicle for fortification.
- Regular food aid diets do not contain energy-dense food for very young children. They need complementary foods. Children who need rehabilitation require foods that go beyond oil, sugar, and dried skim milk power.

* * * * * * * *

The Nuts and Bolts of Fortifying Cereal Commodities

Case Study: Zimbabwe Drought 1992-1994: Fortification of the Staple for Emergency Feeding

Judith R. Mutumba, Deputy Director of Nutrition, Ministry of Health, Zimbabwe

Since independence in 1980, Zimbabwe has experienced a series of droughts, the most serious and devastating one in 1991-1992. Food stocks had to be brought in from the United States and South America. The 1991-1992 drought had ripple effects extending to the 1993-1994 drought, since many communities had not recovered from the last one. Initially the government provided maize and beans, but when beans ran out, they just gave out maize. This was not an adequate diet for children, so the government began supplementary feeding programs. Children were given a ration comprising maize, beans, oil, iodized salt, and groundnuts that were produced locally and contained the required nutrients. When groundnuts ran out, the ration of beans was doubled, but it did not provide enough niacin. The problem was compounded when both beans and groundnuts ran out. Children under five and school children were most affected. The latter were fainting and stopped going to school. There were few donors to support this program, so the government had to provide the funds for a fortified blended food to replace the ration. The nutrients replaced were only those known to be in the ration, but the ration already had inadequate vitamins C and A.

The frequency of drought in Zimbabwe is likely to increase in the future, given changing global climatic conditions. This has led to the formulation of a National Policy on Drought Management for Zimbabwe, which emphasizes harvesting and efficient utilization of water, increased agricultural productivity in both commercial and communal areas, land use planning, and proper management of natural resources and the environment. There are no policy guidelines on food aid or nutritional support.

In 1995, the Ministry of Health, with support from UNICEF and the Micronutrient Initiative, organized a workshop on voluntary fortification of staple foods by private food processing companies. Two major milling companies started fortifying maize meal with vitamin A, B vitamins, iron, and folic acid. Tenders were floated for the fortified maize meal. This was an incentive for companies already fortifying maize meal.

Fortification of the staple is recommended for emergency feeding because it can:

- Enhance the nutritional value of maize meal by supplying nutrients that the typical food rations would not generally provide
- Supply missing nutrients during shortages of other food commodities, such as vitamin B, which prevents pellagra
- Prevent other micronutrient deficiencies that might occur during drought periods
- Promote the use of locally acceptable, locally produced foods, not imported foreign foods

Strategies

- Initiate dialogue between government and industry.
- Generate public awareness through electronic and print media.
- Further enhance consumer awareness by nutrition labeling of fortified foods.
- Involve key local NGOs in the emergency feeding and fortification program

Food industry constraints

- Monopoly on premix supply and lack of competition make the premix too expensive.
- Some vitamins are lost during cooking, which necessitates increased doses to compensate for losses and thus increases costs.

- Incentives are lacking for companies that decide to fortify their products.
- Technical support is needed to set up internal factory quality control systems, especially for smaller companies.
- Small companies cannot absorb the fortification costs and therefore cannot compete with well established companies.

Government constraints

- Because there is still no legislation on fortification of staple foods, the program may not reach most vulnerable groups.
- The government laboratory lacks the capacity to verify fortification levels, especially for vitamins.
- Enforcement capacity is inadequate to maintain standards once legislation is passed.

Consumer constraints

- People lack adequate knowledge of the benefits of fortification.
- People lack access to fortified foods due to increased cost.

Recommendations

"Sensitize consumers, even those receiving food aid, to their nutritional requirements and to the nutrients that are being supplied through their diet."

- Pass legislation making fortification of the staple with some specific nutrients mandatory.
- Develop governmental laboratory capacities to monitor and enforce the correct level of fortification and proper labeling.
- Provide technical support for companies to set up quality assurance systems in production plants.
- Train food inspectors and laboratory technicians to help monitor and enforce fortification programs.
- Sensitize consumers, even those receiving food aid, to their nutritional requirements and to the nutrients that are being supplied through their diet.

Case Study: INCAP's Experiences in Relief Situations after Hurricane Mitch in Central America
Dr. Florence Tartanac, INCAP, Guatemala

INCAP has extensive experience in fortifying foods, but until last year it was mostly involved in long-term programs, fortifying sugar with vitamin A, salt with iodine, and wheat flour with iron. For schoolchildren, INCAP also fortifies cookies and INCAPARINA, sold on the open market. After Hurricanes Mitch and Georges struck Central America, INCAP was asked to help.

Immediate actions taken right after the disaster (short-term)

- Dissemination of two technical documents, "Food and Nutritional Security in Disaster Situations," and "Humanitarian Assistance in Disaster Situations." Both documents are available on the INCAP home page: www:incap.org.gt .
- Distribution of fortified foods in several refugee camps in Guatemala, through the Ministry of Social Welfare. The Ministry bought INCAPARINA and maize flour fortified with soybeans and micronutrients, both produced by national firms using the INCAP formula. INCAP trained Ministry personnel in the use of fortified foods, and supervised plant production and distribution. Approximately 5,000 persons in 30 refugee camps were covered over a two-month period.

Rehabilitation actions (long-term)

- Technology transfer in affected communities to create small-scale bakeries producing fortified bread with soybeans and micronutrients. This project was already in progress before the hurricane, as a food security project. Four bakeries had been started, three in Guatemala and one in Honduras. Women's groups were organized and trained in food security. INCAP loaned each group US$4,000-$5,000 for construction, equipment and working capital. INCAP also provided management training and technical assistance over a six-month period for the purchase and installation of bread-making equipment.

  After the hurricanes, many in the rural areas were without jobs or agricultural resources. Part of the cereal crop was destroyed as well. INCAP developed several project proposals for these populations to make fortified bread and cookies for schoolchildren. In the Dominican Republic, several women's groups were trained in the production of fortified bread and a proposal was written to create five small-scale bakeries to produce bread and cookies for schoolchildren. In Guatemala, two communities affected by Hurricane Mitch will have bakeries, with funding and assistance from IDRC. In Honduras, a proposal was written to get funding for small-scale bakeries to product cookies for schoolchildren. Some constraints to setting up this project after an emergency are lack of funds, slow response from financing agencies, and lack of pre-existing organization in the community.

- Food self-sufficiency at the local level through short-cycle crop production is another way to address nutritional issues. In the Dominican Republic, this system was applied with small farmers affected by Hurricane Georges. With technical assistance from the Ministry of Agriculture, 1400 small farmers could each produce enough food to provide one family with 50% to 75% of their RDA of energy, protein, vitamins and minerals, on a plot of 1000 square meters.

"Food self-sufficiency at the local level through short-cycle crop production is another way to address nutritional issues."

* * * * * * * *

Fortifying Staple and Blended Foods

Issues Affecting Implementation
Quentin Johnson, Consultant, The Micronutrient Initiative

Successful fortification programs tend to use staple foods. This is just one of a variety of options to improve nutritional status.

Steps in the development of a food fortification program

1) Determine the prevalence of micronutrient deficiencies.
2) Segment the population if prevalence data indicates the need.
3) Determine the micronutrient intake from a dietary survey.
4) Obtain consumption data for potential vehicle foods.
5) Determine micronutrient availability from the typical diet.
6) Seek government support, from both policy makers and legislators.
7) Seek food industry support.
8) Assess the status of potential vehicles and the processing industry chain, including raw material supply and product marketing.
9) Choose the type and amount of micronutrient fortificant or mixes.
10) Develop the fortification technology.
11) Perform studies on interaction, potency, stability, storage, and organoleptic quality of the fortified food.
12) Determine bioavailability of nutrients in the fortified food.
13) Conduct field trials to determine efficacy and effectiveness.
14) Develop standards for the fortified foods.
15) Define product, packaging, and labeling requirements.
16) Develop legislation and regulations for mandatory compliance. Food fortification programs that have been successful have generally been mandatory.
17) Promote campaigns to educate and improve consumer awareness.

Conditions for success

1) Political support, from within the nation and from donors
2) Industry support
3) Adequate application of legislation, including external quality control
4) Appropriate fortification level
5) Good bioavailability of the fortificant
6) No inhibitory effect of the common diet
7) Human resource training at industry and marketing level
8) Consumer acceptability (consumers can reject even donated food)
9) No cultural or other objections against fortified foods
10) Adequate laboratory assessment of micronutrient status
11) Adequate study design or statistical evaluation
12) In the case of iron deficiency anemia, absence of parasitism or other non-dietary causes of anemia
13) No constraints regarding procurement of micronutrients

Relevant Criteria for Selection of FortificationVehicle	
Consumption criteria	Coverage of a high proportion of the population Regular consumption in consistent amounts Minimum variation in consumption patterns among individuals Minimum regional variation in consumption patterns Appropriate serving size meeting significant proportion of the daily dietary requirement Consumption not related to social status Low potential for excessive intake No change in consumer acceptability No change in food quality
Processing and storage criteria	Centralized processing Simple low-cost technology High stability and bio-availability Minimal segregation of the fortificant and vehicle Good stability during storage No micronutrient interactions
Marketing criteria	Appropriate packaging to ensure stability Labeling according to international or national standards Adequate turnover rate
General criteria	Good bio-availability No noticeable effect on flavor or color, especially when the product is white Affordable cost Color, solubility, and particle size acceptable to consumers Free commercial availability of food grade material Availability of fortificants in encapsulated form if required Feasibility of addition and dispersion; dry blending or spray coating

Micronutrient Fortification of Wheat Flour Products
Quentin Johnson, Consultant, The Micronutrient Initiative

Wheat flour fortification in North America involves the following micronutrients:

- Vitamins: vitamin A (export flour from the U.S.), vitamin B complex (thiamin, niacin, and riboflavin), folic acid, vitamin B6, and pantothenic acid
- Minerals: iron, calcium, and magnesium

For the industry, the rationale for flour fortification includes the following:

- Possible contribution to a healthier society
- Opportunity to become a trailblazer in your industry
- Opportunity to expand the market by offering a superior product

- Possibility of receiving government endorsement of your product
- Possibility of your product being used in public health programs
- Ability to be part of a collaborative program with possible technical and promotional support of government, international agencies, and NGOs—potential global partners would include The Micronutrient Initiative, UNICEF, The World Bank, WHO, USAID (the MOST Project), International Life Sciences Institute (ILSI), and the Program Against Micronutrient Malnutrition (PAMM).
- Frequent inclusion of cereal flours and products in subsidy and nutrition programs

Fortification methods for cereals
Dry mixing types include batch mixers (drum, screw, ribbon blender, air mixer) and continuous mixers. The preferred point of fortification is at the point of production. Large-scale mills use continuous addition, with volumetric or gravitational feeders. Small-scale mills use hammer mills, stone mills, hand-operated blenders, plastic pail inserts, or mixing pails.

Economics of Flour Fortification[1]	
Capital investment	$5,000 to $15,000 for feeder, including additional parts and installation
Operating cost	5% to 10% of cost of fortificant premix. Includes labor, equipment depreciation, maintenance, quality control, and administrative costs
Premix cost	Depends on fortificant(s) required: Elemental iron - $1.09/kg Iron, folic acid premix - $3.63/kg Iron, thiamin, niacin, riboflavin premix - $6.95/kg

Cost of Flour Fortification Program: An Example	
Premix	Contains reduced iron to be added at 30 ppm, folic acid at 1.5 ppm
Treatment rate	100 grams per metric ton
Premix cost	$3.63 per kg
Fortification cost	$0.36 per metric ton
Annual cost for 200 tons per day	$20,000

Cereals are simple to fortify. They are dry, free-flowing particles, and the fortification technology is 50-60 years old. When micronutrients are added, the cereals can remain stable under diverse transportation and processing conditions.

Fortification in Small-scale Mills
Dr. Louis Laleye, The Micronutrient Initiative, Canada

Background
Food fortification is one of several strategies currently being applied for the control and prevention of micronutrient deficiencies in developing countries. The fortification of culturally acceptable

[1] Canadian dollars.

foods, particularly cereal flours, is believed to be a viable option with the potential of meeting the daily micronutrient needs of a significant proportion of the target population, thus providing a long-term solution to micronutrient deficiencies in these populations. Attention is thus increasingly being directed to identifying ways to fortify staple foods consumed by populations who are not only poor but also most vulnerable to micronutrient deficiency.

In sub-Saharan Africa, as in many developing parts of the world, the target groups live mostly in rural areas and consume very little, if any, industrially processed foods. Mechanical milling of staple foods, where required, is usually done in hammer mills. Hammer Mills are very popular in sub-Saharan Africa. They constitute the first move toward mechanized food processing away from the traditional mortar and pestle flour processing technique. Hammer mills are commonly used in rural, semi-urban, and urban areas all over the subcontinent. The challenge is therefore to develop and test an appropriate technology for micronutrient fortification of cereal or tuber staple flours milled in hammer mills.

"The challenge is therefore to develop and test an appropriate technology for micro-nutrient fortification of cereal or tuber staple flours milled in hammer mills."

UNICEF/Zambia in 1995 explored the possibility of fortifying maize meal in small hammer mills with a premix containing one or more micronutrients. In response to the request from UNICEF, the Micronutrient Initiative conducted a study of hammer mill operating environment and practices in Zambia and concluded that fortification was feasible within the relatively poor infrastructure of small maize mills in the country.

Milling conditions

Although the same basic fortification technology is applied for both large-scale and village-level fortification, at the village level the technology need to be simple and easy to apply to small volumes of processed food. This is true of the hammer mills. The clients (mostly women) mill small (2-5 kg) quantities of maize each time.

In Zambia, mill owners have limited financial resources and their operators usually have limited technical skills. Most of the operating hammer mills have cyclone separators, which generate flour dust during the milling process, resulting in up to 10% loss in the finest-size fraction of the milled product. This is a significant loss to customers, who are unaware of the final weight or volume of the finished product. Installation of sophisticated metering equipment with the capability of automatically adding minute doses of fortificant premix to variable volumes of flour (as is done in Venezuela) is therefore considered inappropriate in such hammer mills, and is not affordable for the rural clientele.

Identifying appropriate blenders

In its feasibility study of maize milling environment and practices in Zambia, the Micronutrient Initiative showed that a micronutrient premix powder could be added to maize meal at the processing point (hammer mill) using inexpensive hand-operated blending equipment. Since millers handle only small amounts of grain during each milling cycle, different types of blenders could be identified and tested. Some blending requirements, however, needed to be met:

- Premix had to be added after milling.
- The proportion of meal to premix had to ensure optimum consistency of the final product.
- The remix had to be stable, safe, and easy to add.
- Blenders had to have few moving parts, and be rugged and cheap, portable, manually operated, and easy to fabricate and repair.
- Effective blending had to take place in 3-5 minutes.
- The concept and use had to be acceptable to customers (mill operators and consumers).
- Both the blender and the premix had to be affordable.

Six blenders were tested for rate of mixing, quality of mixing, and cost of the blending systems. Testing was performed using maize meal milled in a hammer mill. The premix powder contained reduced iron, vitamin A, and other minerals. The premix was added at the rate of 25g per 100g of maize meal, and samples of blended maize meal were taken at 1, 3, 5 and 10 minutes. These were analyzed for their content of reduced iron.

Findings
Of the six blending methods tested, the **Hand Operated Stainless Steel Blender** (HOB) and the **ODJOB Mixing Pail** showed the most promise in terms of mixing efficacy. The HOB is a US$950.00 stainless steel ribbon blender originally developed for iodizing common salt in many developing countries. The ODJOB Mixing Pail is a 25-liter plastic pail with integral baffles that facilitate mixing, designed for mixing up to 60 kg of cement and costing US$10-US$12. Preliminary analysis of the premix-maize meal blends suggests that satisfactory mixing can be achieved in 3-5 minutes using either type of blender.

Conclusion
Since the identification and testing of the HOB and ODJOB blenders, the Micronutrient Initiative has supported studies in Zambia to assess both millers' and consumers' acceptance of the concept of food fortification, the use of blenders after milling, and the addition of premixes to their milled products.

Perhaps a more difficult task, particularly in sub-Saharan Africa, is ensuring consumer acceptance of fortified products, which involve the issues of color, taste, texture, and affordability. There is also the question of packaging and distributing the final fortified products. No doubt the need created among community members for fortified maize meal would determine the degree of success of the attempts at maize flour fortification. Community mobilization and social marketing techniques are also necessary to encourage rural consumers to accept fortified maize flour, particularly since the benefits of the added micronutrients will not be immediately visible.

Case Study: Malawi Maize Flour, Village Hammer Mill
Neal Hammond, SUSTAIN Volunteer

Interest in anti-nutritional factors in foods has increased over the last few years. Some anti-nutritional factors include:

- proteins - lipase, trypsin inhibitor, hemaglutinin-lectin
- non-proteins - dietary fiber, phytin, phenolics

When nutrients are added to foods, anti-nutritional factors can be eliminated or neutralized by adding enzymes. Lipase can be broken down easily. Enzymes specific to anti-nutritional factors can also be added to local products.

In Malawi, adding micronutrients at the mill level is being considered. This requires several techniques. The airblown feeder, in which air spins the wheel, is one such method, but the women who bring in maize want the flour to be theirs and not someone else's, so crossover in the final product should be avoided. A good example of appropriate technology is a simple volumetric feeder that was actually made to add cappuccino to water. Most feeders cost US$5000 to US$10,000, but this one costs US$5.00. It can be attached to a motor and the material comes out in uniform amounts, accurate to within one to two percent.

Developing the infrastructure for adding micronutrients at the village level is a problem to be solved. Malawian bakers have heard that the U.S. only adds iron and B vitamins to its flour, and then are asked to add vitamin A. By eliminating vitamin C and calcium, donor agencies could perhaps donate the premix for a few years to get the technology started. Going to a commercial mix and increasing demand would then be easy. The ultimate goal is to get nutrients into a feeding system that can be used by greatest number of consumers.

Fortification of Maize and Complementary Food: A Case Study from Malawi
Alison Tweeddale and Theresa Banda

MICAH, or MICronutrients And Health, is a five-year, CIDA-funded program managed by World Vision Canada. It is currently operating in five African countries. In Malawi, the project involves 13 partners and 1.8 million beneficiaries, focuses on interventions to address iron and iodine deficiencies, and targets the most vulnerable communities throughout the entire country. Fortification was chosen because of demonstrated need. A baseline survey showed that 55% of children under five were stunted, 84% of children were anemic, and 58% of pregnant women were anemic. The target population lives in conditions of extreme poverty and the diet is of very poor quality with little variety to supplement maize, the staple food. Multiple strategies are used to improve iron status: supplementation, malaria and parasite control, fortification, and dietary diversification.

One of MICAH/Malawi's partners is the Domasi Presbyterian Mission, which was founded in 1896, abandoned in the 1940s, and revived in 1991. The mission has extensive facilities, including a church, schools, primary health care facility, cow barn, factory, and mill. The Domasi Community Nutrition Project includes a maize mill, growth monitoring and primary health, and feeding centers for malnourished children. Domasi was the ideal place to carry out the project because of its existing capacity. The mill and factory were put in place through MICAH assistance, and community and political support were strong. In addition, background work was available on Likuni Phala, a fortified blended food made with maize and soya, as were resources from MICAH Malawi.

The Domasi area has a high prevalence of malnourished children who depend on supplementary food distribution (Likuni Phala and maize). These products were provided through WFP food assistance to the government of Malawi during the past decade. However, as this project has now phased out, the Domasi Mission needed to find its own means of producing the supplementary food. Similar processing of fortified food already exists within the country at mission hospitals.

The products are sold to hospitals, communities, and retail outlets through the Likuni Phala Association.

Likuni Phala is well known throughout Malawi as a complementary food, particularly for malnourished children, and is sold to community members and used by feeding centers for malnourished children. Only one other company in Malawi fortifies *mgaiwa*, or unrefined maize meal, so Domasi is showing leadership in this area. It produces 3.5 MT per week for the community and 2 MT per week for commercial sales.

The vitamin/mineral premix for fortification is obtained from Roche Laboratories in South Africa, but the project is currently investigating Canadian sources. The premix is mixed with the Likuni Phala or maize by rolling a ribbed bucket on the floor for seven minutes. The amount of space and the length of time required are constraints to the process. Also, the lid tends to pop off the bucket. This method of mixing in fortificants is a temporary measure until a blender can be procured.

"Social marketing is essential so that people will know what fortification is and why it is being done. Sustainability will depend on production and sales. Commercial sales should cover the cost of fortification to the community."

Social marketing is essential so that people will know what fortification is and why it is being done. Meetings were held with community leaders in Domasi, and samples were given out to gain support prior to starting the project. IEC strategies directed to community members included fortification messages on flour bags and t-shirts. Mission health center workers were trained to promote the message that fortified maize meal was not just a complementary food, but good for the whole family. Community Health Workers and volunteers also promoted Likuni Phala. In the mission feeding centers, Likuni Phala is used to rehabilitate malnourished children and families are able to see a visible positive change in their children.

Sustainability will depend on production and sales. Commercial sales should cover the cost of fortification to the community. Domasi plans to explore other markets for their products so as not to depend only on the local community. It is hoped that Likuni Phala can be promoted as a commercial complementary food. Equipment, supplies and staff must also be maintained. In terms of impact, a decrease in malnutrition and improved growth are expected in children under five. It is also anticipated that the iron status of women and children will improve, and micronutrient deficiency diseases will be reduced or prevented in the overall population, by the use of Likuni Phala in combination with other strategies.

The possibility of adding phytase to the premix as an anti-nutrient is being explored. This is a potential area for research in partnership with academic personnel. Another possibility is to implement fortification in village mills, using appropriate technology such as bicycle parts to replace manual rolling of the bucket. This would require social marketing and cost studies. MICAH/Malawi is currently developing a project to field test community-based maize meal fortification.

Village-level fortification involves more operational challenges and complications than fortification by Domasi and other small-scale producers. The equipment is difficult to obtain in Malawi. There are personnel questions, such as who will add and blend the premix, and who will provide supervision for quality control. Cost is another issue. The cost of the premix for the project will be

covered by World Vision, but the communities will have to bear the cost when the grant is used up. Finally, a protocol is needed to develop standards for fortification and quality control in Malawi. MICAH/Malawi is involved in capacity-building with the Malawi Bureau of Standards to address this issue and others.

Options for Nutritional Improvement of Non-grain Relief Commodities

Fortification of Salt
Dr. John Dunn, University of Virginia

Iodine deficiency is the world's most prevalent cause of preventable mental retardation. Other major consequences are decreased child survival, growth retardation, goiter and thyroid diseases, impaired reproduction, and decreased educability and productivity. The principal means for correcting iodine deficiency are fortified foods (salt, water, bread), iodized water, iodine in donated foods (dairy products, meat, fish, vitamin supplements), and capsules of iodized vegetable oil. The choice depends on local geographical, political and socioeconomic factors.

Iodized salt is overwhelmingly the first choice for correcting community iodine deficiency. Salt is a daily dietary requirement for rich, poor, old, young, male, and female alike. It is frequently the only essential food commodity that must be brought into the community from the outside. The technology for salt iodization is simple and doesn't cost much. At the village level, salt can be iodized either by manual spraying of iodine onto salt during processing or by hand mixing of dry potassium iodate with sodium chloride. Salt iodization programs in schools cost next to nothing.

"Iodized salt is overwhelmingly the first choice for correcting community iodine deficiency, the world's most prevalent cause of preventable mental retardation."

Iodized salt has several potential limitations:

- The quality of the salt needs attention. Upgrading the quality of the salt can add to cost.
- Effective distribution is important to ensure that all of the target population receives adequately iodized salt. Distribution is easier to control with a few large producers than with many small producers scattered over large areas.
- The cost of iodized salt should be competitive with that of non-iodized salt. Laws should also require iodized salt for animals.
- A salt iodization program must have quality control at both production and consumption sites to ensure that optimal iodine reaches the target population.

Salt is occasionally considered as a vehicle for other nutrients, particularly fluoride and iron. This fortification is feasible and occasionally successful, but requires more complicated technology, greater cost, and a higher quality salt.

Monitoring is an essential component of successful salt iodization. The iodine content of the salt needs to be kept within the proper range. It is fairly safe, but too much iodine can occasionally have an adverse effect. The development of hyperthyroidism in older people or a few deaths can

slow down programs to help children. Impact is best monitored by measuring urinary iodine concentration. Additional measures are assessment of thyroid size and hypothyroidism.

Monitoring is also important to ensure that programs do not deteriorate. This has happened in some countries because of apathy (Guatemala), civil strife (Mozambique and El Salvador), or natural disasters (Ecuador).

Conclusions

- Most regions requiring food relief are iodine deficient.
- The main consequences of iodine deficiency are mental retardation, goiter, and decreased child survival.
- Iodized salt is the best but not the only means for correcting iodine deficiency.
- Monitoring of people and of salt is essential for assuring optimal iodine nutrition.

* * * * * * *

Discussion Section - Main Points

- Traditional fermentation techniques used to make local beer could be used to produce complementary foods on a small scale.
- More attention needs to be paid to all micronutrient deficiencies. This includes zinc deficiency, which is probably as prevalent as iron deficiency.
- We need to evaluate iodine intake, but it is always good to give refugees iodized salt.
- Vitamin C could be provided through blended foods, especially if made into a drink. It can also be given in traditional drinks. Chlorinated water destroys vitamin C.
- Mandatory fortification of staple foods requires considerable investment, quality control, and foreign exchange. Fortification is important for emergency situations, especially when people are not aware that nutrients are missing in their diet.
- Fortified food aid can pave the way for widespread efforts to feed non-refugee populations.
- Household-level fortification was tried in a refugee camp in Uganda and in villages in Malawi. It is feasible, provided safety and food security are not issues.

* * * * * * *

Sugar Fortification with Vitamin A: Possibilities for Use in Relief Situations[2]
Dr. Florence Tartanac, INCAP, Guatemala

Fortifying sugar with vitamin A in Central America started in the 1970s, but programs acquired permanence only in the early 1990s. Today there are national sugar fortifications programs in El Salvador, Guatemala, Honduras and Zambia. Other countries, including Nicaragua, Bolivia, Brazil, Colombia, Mexico, India, the Philippines, and Swaziland, have plans for sugar fortification with vitamin A.

[2] The author thanks Dr. Omar Dary for providing recent information regarding sugar fortification programs.

Characteristics of Sugar Fortification Programs in Central America

Fortification process
The sugar is fortified with vitamin A by mixing sugar, either standard or refined, with retinyl-palmitate beadlets, vegetable oil, and antioxidants. In addition to retinol, the beadlets contain antioxidant substances and a gelatin matrix, which increases the stability of vitamin A under adverse environmental and commercial situations. They also make the water dispersible. Vegetable oil acts as an adhesive between the beadlets and the sugar crystals.

In Central America, the fortification process consists of adding the vitamin A premix over the sugar during the final steps of production, either before or after drying. The latter is preferred because some of the vitamin A beadlets are separated from the sugar crystals by wind currents inside the drying turbines.

Level of fortification coverage
In 1998, the mean content of retinol in sugar found at the household level was 6.9 mg/kg in Guatemala, 8.3 mg/kg in Honduras, and 9.3 mg/kg in El Salvador. For the 1997-1998 sugarcane harvest, 97% of Guatemalan households, 82% of Honduran households, and 96% of Salvadoran households had sugar fortified with vitamin A.

Impact of fortification
Severe vitamin A deficiency has been overcome in the three countries, except in children under three years of age whose sugar intake is naturally low. Recent national surveys indicate that the number of preschoolers with low levels of plasma retinol (<20 μg/dl) was reduced from 40% (1967) to 13% (1996) in Honduras, and from 27% (1987) to 14% (1995) in Guatemala. A 1998 survey in El Salvador revealed similar findings.

Cost-effectiveness analysis
In 1991, the Latin American and Caribbean Health and Nutrition Sustainability Project, supported by USAID, carried out a cost-effectiveness evaluation of three interventions to prevent and correct vitamin A deficiency: sugar fortification, supplementation with vitamin A capsules, and promotion of vegetable production and consumption. The study concluded that sugar fortification had the largest coverage and was most cost-efficient—US$0.98 per person at risk and US$0.40 per person for the whole population covered. Supplementation covering only pre-school children was US$1.52 per child, and promotion of vegetable consumption was US$3.63 per person[3].

Possibilities in Relief Situations

Sugar fortification has been an effective and efficient intervention for preventing and overcoming vitamin A deficiency in Central America. Some limitations have been identified, such as a non-homogenous final product, and 40% to 50% retinol losses during the shelf-life of the product (over 8 months). However, this is normal for vitamin A when used as a fortificant in other foods. Sugar is frequently provided in food aid rations and it can serve as a vehicle for increasing vitamin A intakes of refugees. It should also be used more widely in developing countries affected by this deficiency.

[3] Phillips M., T. Sanghvi, R. Suarez, J. McKigney, and J. Fiedler. 1996. The costs and effectiveness of three vitamin A interventions in Guatemala. *Soc. Sci. Med*. 42 (12):1661-1668.

Fortification process
As most sugar used in relief situations is not fortified, except in countries where the program already exists, it would be necessary to fortify the sugar and then re-process it before consumption. In this case, the fortification could be done with a simple mixing machine consisting of two feeding chutes, one for sugar and the other for the vitamin A premix, and an endless screw for blending. The system requires a minimum length to ensure sufficient mixing, but fortification could be done with national or imported sugar before packaging.

Level of fortification coverage
It would be possible for 100% of refugees to have fortified sugar, and for 80% of that sugar to have retinol levels above 5 mg/kg. Such levels would ensure that the mean retinol content in sugar was at least 9 mg/kg during the year. This would provide nearly 100% of the RDA of vitamin A for most persons from sugar alone, completely fulfilling the nutritional goal of providing 50% of the RDA for most of the population, with only children under the age of two receiving less.

"Fortification of sugar with vitamin A has never been tried in relief situations, but given the Central American experience, INCAP recommends that it be done. There are no major technical or economic constraints, and the impact on nutritional status is rapid."

Quality assurance
A simple quality assurance system is essential if the program is to have significant impact. This consists of a quality control component carried out by the producer (i.e., the firm in charge of fortification and packaging); monitoring at the factory, warehouse, and refugee camps by government personnel; and surveillance of the final product at the refugee/consumer level.

Conclusion
Fortification of sugar with vitamin A has never been tried in relief situations, but given the Central American experience, INCAP recommends that it be done. There are no major technical or economic constraints, and the impact on nutritional status of the population is rapid. Moreover, it would be a good way to introduce the program in countries where vitamin A deficiency is already a public health problem, setting it up for the whole population on a long-term basis. The only limitation is the reduced impact on small children, but this could be solved by targeted supplementation.

Micronutrient Sprinkles: Research Results and the Potential for Relief Settings
Stanley Zlotkin, Hospital for Sick Children, University of Toronto

Sprinkles were first developed to deal with micronutrient deficiencies in infants. Breast milk is sufficient for the infant's first six months. For the next six months, it needs breast milk plus complementary food, which is usually a grain-based cereal. In North America and Europe, infant cereals are fortified with iron, zinc, and other nutrients. In the developing world, complementary foods are usually made with one staple food and do not contain enough micronutrients, so the infant is at risk for micronutrient malnutrition.

Traditionally there have been three choices for treatment or prevention of micronutrient deficiencies: increased variety of foods, food fortification, and individual supplements. Each presents problems when it comes to infants. An increase in the variety of foods is often not possible, since complementary foods in developing countries use local staples such as maize, rice,

or wheat. Food fortification works well for commercial complementary foods, but these products are expensive. Individual supplements are also very expensive, and involve additional compliance and distribution problems. For instance, the current iron supplements for infants come in syrup, which stains teeth and has a bad taste. In addition, the supplement comes in a glass bottle and must be measured out.

Sprinkles were developed as an alternate source of micronutrients. Since every infant goes through weaning, adding individual fortificants made sense. The next step was to develop a delivery system for the Sprinkles, and this system was a simple sachet. The sachet was not a new idea. It had already been used to deliver ORT, sugar substitutes, and milk substitutes. The beauty of a sachet is that you can put anything in it and deliver it individually. In this case, the contents could be coated iron, zinc, vitamin A, iodine, ascorbic, acid, etc. Advantages and disadvantages of coated Sprinkles are listed below.

Advantages	Disadvantages
They can be added directly to food and the coating prevents interactions between the micronutrients and the food that might change taste or color. They can be added to any semi-solid foods with the consistency of porridge or thick soup. They are easy to use and literacy is not needed. They are lightweight and easy to transport. They are inexpensive and require low technology to manufacture. Inadvertent poisoning is unlikely, especially compared to bottles of pills or liquid.	Their efficacy is not yet established. Field testing would have to determine whether the nutrients are being absorbed from the various foods they might be used with, especially higher fiber foods, and whether the coating interferes with absorption. Effectiveness still has to be tested as well. People may not use them just because they are simple and convenient: cost may be a factor.

USAID has funded research projects in Nicaragua (sachets with coated iron, ascorbic acid and zinc) and Ghana (coated iron and vitamin A). Target populations include infants and children, adolescents, women of childbearing age, pregnant and lactating women, and the elderly. Findings should begin to emerge in the next twelve months.

Until now, Sprinkles have not been considered a way to improve relief diets for refugees, but they probably could play a role. They are easily added to food, right at the table or feeding site. They are likely to be acceptable since they do not change the taste or color of the food to which they are added. They are inexpensive (less than five cents a sachet) and easy to transport. However, using Sprinkles in relief aid does pose certain problems. An increase in the variety of foods is most often not possible for economic and security reasons. Food fortification works for some foods, but not for others. It gives great value, but may not be viable for practical reasons. Individual supplements also run into cost, compliance, and distribution problems. It is important to consider

safety issues and individuals' need for hope. Preserving health is linked with preserving dignity. In conclusion, Sprinkles are worth testing in a relief situation.

Vitamin A Fortification of Title II, P.L. 480 Vegetable Oil
Peter Ranum, SUSTAIN Consultant

Vegetable oil (or *vegoil*, as it is often called) is nearly always included in a food basket of rations for emergency and relief situations. Vegoils are used as the main source of fats, supplying essential fatty acids and increasing the caloric content of the diet. They are also useful in cooking and make many foods more palatable. Frying foods in oil at high temperatures helps break down vegetable matter, making it more tender and easier to digest in a shorter cooking time. Oil also keeps food from sticking to cooking pots.

The U.S. donates about 145,000 metric tons of vegoil a year under U.S. Public Law 480, (P.L. 480), which reaches about 20 million people in over 40 countries. Every recipient consumes some oil, but in sparing amounts because of its relatively high cost. At an average base cost of $0.84/kg, vegoil is the mostly costly by weight of normal food aid commodities, about three times the cost of processed cereals. However, on a per calorie basis, the cost is about the same. Rations are about 10-30 grams per day, putting food aid recipients on a low fat diet. Vegoil is supplied in metal containers (4 liters, 20 liters and 208 liters) and in bulk.

Because of its high value and wide demand, vegoil is often used in bartering and monetization programs. In FY 1997, PVOs monetized about 45% of the total shipments. The oil is sold to traders, often in urban areas, and some finds its way into retail markets as a mid- to premium-priced oil. Most is sold to industry for reprocessing and packaging or for use as an ingredient in a variety of value-added food products, particularly the bulk shipments and 208 liter barrels, which account for 29% of P.L. 480 oil.

Most sources doubt that this monetized oil reaches the target population, since mid-priced oil products or value-added products are not generally found in their daily diet, particularly in rural areas. Interviews with several PVOs indicate that some P.L. 480 oil does reach the urban poor in the form of street foods. However, these are often deep- fried foods, with oil used over and over at high temperatures.

Vitamin A
Vitamin A is a fat-soluble vitamin found pre-formed only in meats and dairy products. It can also be obtained from beta-carotene in plants. Measured in international units (IU) or retinol equivalents (RE), needed amounts vary greatly depending on age. The upper safety intake limit in pregnant women ranges from 10,000 to 15,000 IU/day over extended periods. Vitamin A deficiency is a serious problem affecting millions of people worldwide, particularly children. It causes eyesight problems and blindness, reduced resistance to infection, and reduced iron absorption. However, the problem is solvable.

Vitamin A fortification of food staples
Vitamin A has long been added to cereal-based food staples provided under P.L. 480 Title II food aid:

- wheat flour, cornmeal and bulgur – 2205-2644 IU/100g
- Corn Soy Blend (CSB) and Wheat Soy Blend (WSB) – 2315 IU/100g

- vegoil (starting in 1999) – 6000-7500 IU/100g

World Food Program foods are also fortified with vitamin A:
- CSB – 1664 IU/100g minimum
- vegoil – 5000 IU/100g (EU) to 6000 IU/100g (CIDA)

Comparison of Vitamin A Delivered to Children from Vegoil and CSB

	vegoil	CSB
Content IU/100g	**6000**	**2315**
Ration g/day	**10**	**30**
Retention %	**85**	**50**
Delivered IU/day	**510**	**347**
% RDA	**38**	**26**

Notes: Data based on rations and RDI for children 1-6 yrs. WHO RDI is 1333 IU/day. Content is minimum standard for fortified food product. Vitamin A retention for CSB is in gruels, higher retention is possible in other foods prepared from CSB, i.e. ugali. Cost is base cost per rations for undelivered commodities.

In order to better assess the actual amounts of vitamin A and other essential nutrients being delivered to food aid recipients, USAID commissioned a study to investigate the levels, uniformity, and stability of micronutrients added to Title II foods. This study revealed that a much lower level of vitamin A was actually delivered in fortified cereal-based commodities than was previously believed. Part of the loss took place during processing and up to 50% was lost during cooking. Improvements in the fortification process are already underway, but losses during cooking will be more difficult to solve with current vitamin A technology. The need for an additional delivery system for vitamin A is apparent.

Vitamin A fortification of vegoil

Fortification of vegoil with vitamin A is a well-established technology. It is currently being carried out in a couple of countries, such as Pakistan, and is fairly simple for industry to perform. No change in current oil packaging is required except for labeling. A study in India concluded that vitamin A added to vegoil would be more stable and less costly than that added to CSB. Losses in the oil were estimated at 5% during shipping and 10% during open storage in the field. Cooking losses were estimated at from 5% from boiling or simmering to 20% from light frying. Another advantage of fortifying vegoil is that a concentrated liquid form of vitamin A palmitate can be used in place of the form required for dry cereals. Since vitamin A is oil soluble, it disperses readily in the oil, allowing for more uniformity.

The USAID study concluded that vegoil could be fortified at a level of 60 to 75 IUs of vitamin A per gram of oil. Ten grams a day would provide children with about one third of their daily requirements. A pregnant woman would have to consume 70 grams of oil a day to exceed the

recommended upper limit, which would be highly unlikely. The additional cost of the vitamin A is about one half of one percent of the cost of the vegoil, a very manageable expense in light of expected benefits. The study recommended that vitamin A should not be added to bulk, crude, de-gummed oils used in monetization, since subsequent refinement of the oil would destroy the added vitamin and most monetized oil does not reach the target population.

Effective December 1, 1998, USDA announced that all P.L. 480 Title II refined vegetable oil would be fortified with vitamin A. USAID, USDA, and SUSTAIN will monitor the fortification to insure it is being properly added and that it is effectively reaching food aid recipients.

* * * * * * *

Discussion Section - Main Points

Sprinkles are used only once a day and infants seem to accept the taste. Right now, people perceive sachets as medicine, rather than supplements. A different form of packaging for preventive use might help people use them regularly. Sprinkles need to be delivered in small volumes to assure accurate dosage and avoid inappropriate access. Sachets provide simple delivery in relatively accurate doses. The dose is doubled for children because half of it is lost.

Food habits/cultural beliefs

- In Europe, salt fortification was tried in public kitchens run by the Red Cross for elderly pensioners, in the belief that salt mixed in food would provide all necessary minerals and vitamins. But it did not work because it changed the taste and elderly didn't like it. Maybe if they had known something beneficial was being added, they would have accepted it or even tried to sell it. The concept of Sprinkles is very good, with adequate marketing.
- We should be aware of the anthropological aspects of changing food habits. It is better to add vitamins to foods already being used.

Policy and legislation

- Many donor countries have legislation against fortifying food aid. It is partly a cost issue: even adding five cents a ration adds up with millions of refugees.
- WFP is unable to meet its quota for milled cereals to be delivered to relief areas. If it were able to do this, the cost of fortification would be more reasonable, as the cost of milling is the major cost in the process.
- It is better to fortify for all people, not just refugees. This is a political decision.
- We should develop strategies for supplements for the whole household, not concentrate on individuals. If one person is sick, the whole family suffers.

Sugar fortification

- It's better to do fortification in the country producing the sugar. Four countries in Central America are fortifying sugar, plus Zambia.
- Local sugar made with sugar cane can be fortified.
- INCAP has found small-scale sugar fortification difficult at, for example, the camp level, and feels it is better to fortify in private factories.
- Fortifying sugar with vitamin A does not shorten its shelf life, although the oil used to bond the vitamin to the sugar shortens the shelf life somewhat. But normally sugar doesn't stay in the store very long anyway. Deterioration only starts when the package is opened.

Labeling/QAC

- P.L. 480 Title II foods have no expiration dates, since some might not get used.
- An expiration date has a negative connotation. "Best used by" is better.
- Right now no one in the chain of supply is responsible for foods that are held up in the pipeline and pass their expiration date.
- Labeling is a question of human rights. Consumers should have information relevant to their use.

Dignity/empowerment

- We want to give refugees hope and dignity. Giving them fortified sachets provides a way to do health education and empowers them to become more active participants and develop skills. People want to be involved in making decisions about their own health, even in a refugee situation.
- Decisions are made by donors, not by the beneficiaries. Beneficiaries should be asked about the acceptability of blended foods and whether they would use something like Sprinkles.

Local production

Once the (fortification) technology has been demonstrated to work in other settings, local or regional production of fortified foods would be possible, especially in East Africa, Asia, and Eastern Europe. Distribution would be similar to the system of UNICEF or NGOs.

Other vehicles for fortification

- Maggi cubes are already used in African villages. However, micronutrients added to Maggi cubes seemed to change the taste slightly, even though people reported that they felt better and slept better.
- In Malawi, a commercial company attempted unsuccessfully to sell small sachets of concentrated proteins, based on milk with vitamins and minerals, as a family meal ration. The cost was higher than fortification.

* * * * * * *

Overall Quality Assurance: Product, Program and Progress
Fritz van de Haar, Emory University School of Public Health

Quality control is a key aspect of food fortification. The most successful food fortification programs have come about when a combination of factors were acting in concert: fortified products delivered by national programs enhanced through information from impact surveillance.

In improving the quality of relief diets, the relevant aspects of quality assurance are:

- Relief food is a means to achieve protection against hunger and malnutrition. Thus the relief food should be seen within the context of the relief program.
- Setting quality standards is always the key step for initiating a quality assurance program, but standards are unique to a given situation. A key question is whether safety, nutrition, or quality standards for food fortification in relief situations are different from those in a stable development situation. Other than in an immediate crisis, standards should be the same.

- In a relief situation, sustained program improvement can be achieved only if the underlying quality standards are accepted and applied collaboratively by all involved.

Fortified products
Food quality management starts with a product design. Once it has defined what it intends to achieve, the company will do all it can to control quality. If problems appear, either through processing or customer feedback, the company improves quality.

Factors in Food Quality Management		
Design	**Production**	**Improvement**
The desired characteristics of a product are defined from an assessment of consumer demand. Based on these desires, companies develop policies on product quality and positioning. A set of definitive characteristics is elaborated and the standards for their documentation developed. The standards and the techniques for the "control" are communicated to all concerned through staff training and empowerment.	The company establishes a system for continuous inspection of the production, input, process, and outcome to make sure what leaves the company is up to standard. The application of this inspection system becomes part of a regular supervision routine. Monitoring against standards for inputs, processes, outputs, and outcomes is continuous.	Identification of the problem Setting of priorities (sometimes the problem is ignored) Development of a solution Implementation of the solution Assessment and refinement

The program
Experience has shown that the most successful national fortification programs are mandatory. The law protects consumers by demanding that fortified food meet standards designed for safety and nutritional adequacy. In relief situations, harmonizing of food fortification standards will allow more efficient contributions from countries where food fortification is not allowed. The major components of a fortification program are the following:

1. *Food production, marketing and supply*
   Once a product enters the market, it is inspected externally for the first time. In developing countries, this is the key point where food inspection plays the most useful role, and can lead to legislation and enforcement. Once the project enters markets and households, enforcement is no longer possible.

2. *Advocacy and communication*
   These are important in making the program run well.

3. *Legislation*

Legislation protects consumers by demanding that fortified food meet standards designed for safety and nutritional adequacy. Safety is as important as nutritional standards. Legislation creates a level playing field for food processors. It would be unfair if some producers were required to fortify while others weren't; voluntary compliance doesn't work. Legislation creates an enabling authority for the fortification program. For instance, legislation could say that all sugar must be fortified and the Ministry of Health is in charge of levels of fortification.

"In relief situations, harmonizing of food fortification standards will allow more efficient contributions from countries where food fortification is not allowed. Setting standards should be a collaboration among government, food industry, consumer groups, and scientists to ensure a sound scientific base, a balanced outcome, no favoritism of the interests of one group over another's, and realistic requirements feasibly attained by both government and industry."

Regulations elaborate the details of the law, including standards. They could specify how much vitamin A should be put in sugar. Regulations are easier to change than laws.

4. *Standards*

   Setting standards should be a collaboration among government, food industry, consumer groups, and scientists to ensure a sound scientific base, a balanced outcome, no favoritism of the interests of one group over another's, and realistic requirements feasibly attained by both government and industry. Finally, harmonized food standards can stimulate trade. Usually standards are elaborated to determine:
   - the food vehicle to be fortified
   - the quality of the fortificant
   - the required level of the nutrient in the final product
   - packaging and labeling
   - storage and handling (first in, first out)
   - documents and/or records required from suppliers for quality assurance

5. *Enforcement*

   Ongoing inspection and enforcement ensure compliance with regulatory requirements. This not only means that food producers have the responsibility to supply consumers with fortified food "according to standards" and can be prosecuted if they are found to be in violation. It also means that legislators and scientists have the responsibility of assisting food producers to improve the products and services that are being mandated.

6. *Impact surveillance*
   Food legislation and product standards are not goals in themselves. Instead, they are aimed at assuring that consumers or intended beneficiaries obtain and maintain good health and nutritional status. Therefore, information on the extent to which the fortified food actually contributes to improved status is important. Assessment of impact helps verify whether the standards are relevant and adequate, and to adjust standards if necessary and feasible. It also determines what needs to be changed in food supply and program implementation.

Lessons learned from ongoing food fortification programs

- All program stakeholders, such as consumers, providers, and government, should be involved in planning, implementation and quality assurance.
- Quality inspection, enforcement, and surveillance are equally important and act in symphony.
- The legal system is merely one component of the program. Legal requirements should be used to improve quality, not only to enforce food producers.
- Communication and information-sharing are critical to sustain the quality of the product, program, and progress, and to prevent problems and misunderstandings.

Issues for discussion

- Who leads in overall quality assurance? You can get any food you want if you are in charge of relief operations, and you can also get quality assurance.
- Who represents the customers' interest? How do you define customer satisfaction in a relief context?
- Can the demonstration of impact be used to drive the program and improve food quality? Or can impact demonstrate quality assurance?

The Potential of Amylase-fortified Cereals in Relief Settings
Noel Vietmeyer, formerly with the National Academy of Sciences

The Power Flour Action Network is trying to remove one underlying cause of malnutrition in children—the lack of infant foods that provide energy density or sufficient calories. The Network is convinced that food-grade malted barley flour, or "Power Flour," could help save lives. This flour is rich in the enzymes that digest starch and turns any hot boiled staple into a fluid, which is easier to ingest. The infant is able to consume more food and hence increase the overall calorie intake, low calorie intake being one of the prime contributors to malnutrition in the under-three population.

The Network is promoting a simple technique that is potentially effective for feeding children at highest risk—the ones born to the poorest of the poor, with poorly nourished mothers or no mothers at all. The technique has been shown to be very promising for use in remote locations, in

times of want, and in the aftermath of natural or manmade disasters. The process is simple and can reach populations where mortality from malnutrition is greatest. It complements breast-feeding and makes the weaning process more successful for the most vulnerable individuals in locations where milk and baby formula are unavailable and where it is difficult to provide energy-dense foods.

The prime "tool" is food-grade malted barley. The white powder is simply ground-up, sprouted barley grain. This is used as a flavoring ingredient in malted milk, corn flakes, grape nuts, bread, English muffins, pizza crusts, candy bars, and many more foods. The United States produces thousands of tons of it annually, but none is now being used in developing countries to improve infant diets.

The approach involves no change in diet, no complex routines to learn, and barely any change in lifestyle. Power Flour would simply turn a portion of the family staple into a form babies can fill up on. Children have difficulty swallowing corn mush, rice, potato, sorghum, and dozens of other "solids." Power Flour converts those boiled staples into liquids to be drunk. It also works with masa, cassava, rice, potato, arrowroot, oats, and barley, i.e., starch from any source.

Using Power Flour is simple. The mother merely adds a small amount of the powder to the hot porridge, mash, or gruel that constitutes the family's basic diet. The conversion occurs almost instantaneously. She passes the resulting sweet fluid to her weanling child, who feeds herself from a cup. The sweet taste reduces the struggle to get a paste down and any resulting digestive problems. The likelihood of water contamination is also reduced. The cost of a teaspoon of Power Flour is less than a tenth of one cent. A Wisconsin group saw the demonstration and raised $20,000 to send samples to developing countries. The response has been positive, and children, the consumers, take to the Power Flour avidly.

Despite some studies of complementary foods made with starch-digesting enzymes, nothing like this instant, barley-based, food-liquefying catalyst has been tried on a large scale. Power Flour samples could be supplied by the local health service, rural clinics, relief agencies, or other organizations. The raw ingredient could be provided in bulk or in pre-packaged form by any industrialized country that makes food-grade malted barley. There is no additional need for FDA approval, because it is already in use.

When relief food is shipped out, about ten bags of Power Flour could be sent along to produce liquid food for children being weaned or very malnourished people too weak to eat solids. It could also be made into tablets that dissolve rapidly. The amount would be pre-measured and micronutrient fortificants could also be added.

Discussion

- Food-grade malt, not malt from local breweries, has to be used for the Power Flour. The process has to be stopped just at the point the enzymes become activated and the grains have to be kept damp for almost a week. This is difficult in the tropics because of mold and mildew. Food-grade malt is prepared in conditions of high sanitation, de-hulled, and ready for direct consumption.
- The inspiration for Power Flour came from a book published by UNICEF and IDRC/Canada about work done in the late 1970s on traditional food processing technologies in eastern and

southern Africa. The book reported experiences in food fermentation and germination technologies, using local foods and done by family members, and scientific studies in fermentation and germination. Some countries in East Africa, e.g., Tanzania, were already promoting Power Flour on a wide scale. The motivation for production was to increase food density. Initially the producers used sorghum and malt—sorghum leaves contain cyanide, though the germinated grains do not—but later decided to use barley.

- Malawi already produces malt flour that is used in children's complementary foods. We should build the capacity of local communities to improve complementary foods, rather than fly in compounds from outside. Foreign aid could be better used to study whether the cyanide issue in sorghum is really a problem.

The Role of Specialty Foods
Steve Hansch, Congressional Hunger Center

Specialty foods can provide a wide range of micronutrients and electrolytes for large numbers of persons in emergency situations, especially those who are deficient in numerous vitamins and minerals. Some examples are:

Specialty foods for feeding severely malnourished persons

- HEM - High Energy Milk
- F-75 - for immediate recovery feeding of a severely malnourished person during the first two to three days of contact, useful during the sensitive period when electrolyte balance is critical and appetite is very low
- F-100 - for recovery of a malnourished person, as in supplementary feeding program
- GBG - formula based on the scientific advisory committee of the French NGO Action Contra la Faim

Infant feeding foods are donated by developed countries. UNHCR, WFP, ICRC, WHO and others have made it clear that these are not appropriate for emergency-affected populations. NGOs, governments, and donors need additional guidelines on how to resist accepting such donations.

Complementary foods produced specifically for use in emergencies

- BP-5 - high protein biscuits, very dry, low weight per nutrient density, stabile
- Biscuits - stable because dehydrated, helpful for children with limited appetites who are bored with porridge and blended foods
- WFP-supported blended foods - include UNIMIX (micronutrient specifications developed by UNICEF), Fafa in Ethiopia, and Likuni Phala in Malawi
- Other emergency foods - include Mainstay rations and Breedlove dehydrated foods

Foods given at times as a form of general rations

- MREs - U.S. military "Meals Ready-to-Eat," common in the 1980s, often in surplus and given away by the U.S. Government. The most expensive of rations @ US$14.00, MREs have good shelf life in any setting, but are not adapted to all cultural situations.
- Humanitarian Daily Rations (HDRs) - patterned after MREs, but less costly @ US$3.95, for short-term needs of camp or at-large emergency-affected populations. HGRs can be stockpiled.

- Sauce - safe and stabile (anaerobic and anhydrous). One example is a sauce piloted by an Italian NGO, made of groundnuts, milk, and sugar.
- Maggi cubes - small soup cubes, ubiquitous, popular, and inexpensive. These are a potentially useful vehicle for carrying fortificants. Initial field tests are being carried out by the University of Aberdeen, Scotland.
- Special drinks or candies - when produced in country, a possible vehicle for carrying vitamin C, though probably at considerable expense and only feasible on a case-by-case basis.

The following table (see next page) summarizes information from a 1997 meeting in Nairobi of NGOs, UN agencies, and food industry representatives. The objective of the meeting was to inform industry representatives about what was happening at the field level, and to help field decision-makers understand more about how premixes differ from processed foods. The latter were interested in costs, shelf life, and quality, and needed guidelines for achieving impact. Many felt insecure about their purchases and needed a framework for a full range of options. The table suggests factors to take into account when deciding which foods to use in different settings.

Strengths and Limitations of Some Specialty Foods[4]

	F-100	BP-5	HDR	Sauce	UNIMIX
Recovery nutritional value	*High*	*Medium*	*Low*	*Medium*	*Medium*
Cost to transport	*Low*	*Low*	*Medium*	*Low*	*Medium/ High*
Spoilage	*Low*	*Low*	*Low*	*Low*	*High*
Cost per Kcal delivered	*High*	*High*	*Very high*	*Medium*	*Medium*
Cost per vitamins and minerals delivered	*Medium*	*High*	*Very high*	*Medium/Low*	*High*
Utility for airdrop or use in flooded or extreme settings	*Low*	*Medium*	*High*	*Medium*	*Low*
Ability to achieve broad population coverage	*Low*	*Medium*	*Medium/ High*	*Medium/High*	*Medium*
Utility for feeding large populations	*Low*	*Medium*	*Medium*	*Good, but limited*	*Medium/ High*
Acceptability	*Limited to inst. feeding*	*High*	*Medium*	*Potentially very high*	*Mixed*
Likelihood of being coveted or stolen	*Low*	*High*	*Medium*	*Medium*	*Mixed*

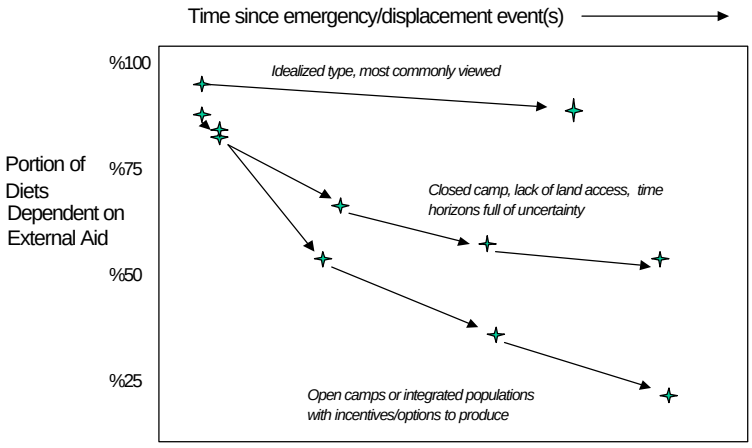
As the table shows, UNIMIX can spoil if it is not bagged, but it has all the necessary micronutrients, including vitamin C. Procurement is easy and the added extruded protein gives it a medium rating for cost/Kcal. Sauces have a widespread appeal and are fairly stable over time. Maggi cubes are already in most markets. Transport is an issue when a lot has to be brought in at once, but if the price of procurement is high, it will not be used over the long term. Generally, people keep going back to UNIMIX and government CSB because they are cost-effective and can be fortified with all micronutrients. CSB can be procured by donors other than the U.S. Government, maybe under different names. Relief workers want something that won't be stolen,

[4] These interpretations are subjective and based on opinions commonly reflected in the field.

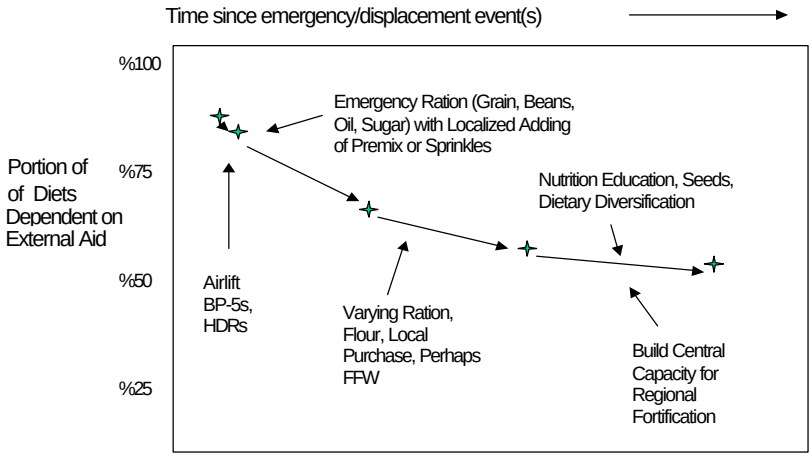
but that people won't dislike either. This is the reason for piloting new sauces or complementary foods.

Phases of a crisis

At each stage of an international relief operation, multiple interventions may be appropriate, each complementing the others (see tables below). The focus of specialty foods is on the time when people still depend largely on food baskets. Over time refugees begin to access local markets. A lot of trading goes on in refugee camps, although not everyone participates.



Phase Space of Refugee Camp Population Average Dependence over Time on Donated Food Ration



Phase Space of Refugee Camp Relief Interventions

Access and delivery considerations
During the early stages of an emergency, access is a factor that affects decisions about which food is brought in. Until a stable food pipeline is established, food may be brought in at dramatically high transport expense (airlift), using prepared regional food stocks (specialty foods), and delivered by airdrops, village-drops, or other untargeted forms.

Cost considerations
Costs per unit and per nutrient delivered vary enormously for the different specialty foods, both in principle and in reality. Some of these foods are highly subsidized by governments, as is the case with the allotment of HDRs the U.S. military procures to maintain in stock at all times for contingencies. The unit cost of other foods is highly dependent on the scale of actual procurement. For example, the cost of F-100 recovery food has dropped significantly in recent years as UNICEF and NGOs such as World Vision have scaled up the volume of their purchases. Whereas a few years ago there were only one or two producers of F-100, today there is a competitive market among five or more producers.

Research needed
- What foods do we currently have? Emergency foods are less efficient at delivering calories and only used for the short term. They are not good for helping malnourished people recover on an outpatient basis. More basic human biology research has to be done on what's best for different populations, such as the elderly.
- Research is needed on how much protein should be in blended foods. Some nutritionists say the practice of including protein is left over from the old days and is not cost effective. In a famine setting, protein can actually be harmful.

Discussion

Food that people say is fortified is not necessarily fortified in a balanced or correct way. Some nutrients cannot be added until the FDA has done toxicity studies. Some milled flours used in emergencies and relief are not enriched or fortified in donor countries. For example, Germany does not fortify commodities; it is not permitted by law. PVOs in Europe who are looking for fortified flour or oil can't find it. Legislation is one barrier. Levels of fortification are another issue.

- *Needs assessments*
  To assess micronutrient deficiency in camps, there is no substitute for hard data on the ground, actually going out and testing. However, it's not just the food that is the problem, but also the quality of care and health environments. Wasted children often have infections.

- *Protein*
  We need to know the right amount of protein, which is the most expensive ingredient in blended foods. Reducing the current 12% or 13% to 10% or 11% would save enough money to pay for all the micronutrients. It's a question of quantity vs. quality and the dollar value. Protein from beans takes eight hours to cook, but hard beans are cheaper to buy. Compared with cereal, beans are more expensive. We could give people fewer beans than they actually eat now.

- *Blended foods*
  We need blended foods because they provide micronutrients. The general ration is generally poor. If we had a better way to get nutrients to people, we wouldn't need fortified or blended

foods. Initially, blended foods were not fortified, but they had to be fortified to stop vitamin deficiencies in refugee camps, which we are still battling today.

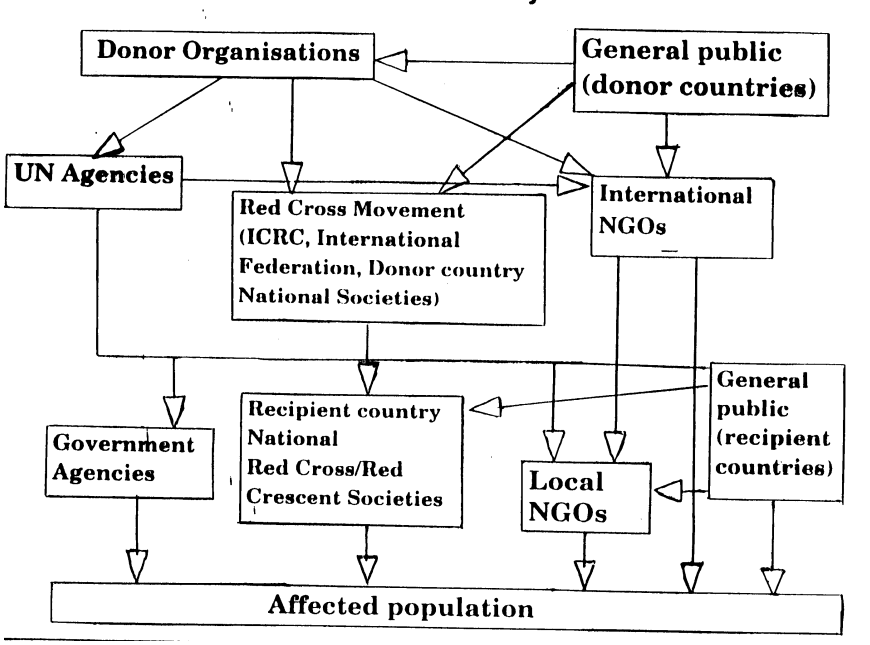
- *Quality control*
  Who controls quality, industry, donor agencies, recipients, or all three? To whom do we complain if the quality of donated food is not good? What if food is expired and not up to standards?

- *Complementary foods*
  We know there is a need for special energy-dense foods for children who are between breastfeeding and eating the general ration. What if we were able to mix water or milk in the Mainstay foods for children, seniors, and the handicapped? It could be used as a staple for long-term nutrition supplement.

How the International Network Works in Emergencies: Role of NGOs, Bilaterals, and Others
Rita Bhatia, UNHCR

If you look at a diagram of the international relief system, you will see too many lines and arrows, too many actors, and problems for coordination. The potential for communication gaps and miscommunication is obvious. Decision making should start with the recipients, but it doesn't happen that way. For example, usually someone in Brussels decides what people will eat in Sudan (see figure below).

Figure 1: The International Relief System



In 1993-1994, 40,000 people died in six weeks in one camp in Goma. A big evaluation was done to determine what happened, who was responsible, and how the same mistakes could be avoided in

future. In this case the military was involved, as it is in Kosovo. We haven't learned much since 1994 about how to improve coordination of relief response to avoid unnecessary deaths.

How does food aid work? Resources flow from the top down within the international relief system. Ideally, a needs assessment should be done with the people. Based on this assessment, WFP should request foods from donors, but the process takes a long time because governments have to tell WFP that they need help. Decisions are made by politicians, who do not understand the context. So they send too much or too little food, and often the wrong food at the wrong time. Sending inappropriate relief items can actually waste precious resources.

Every organization does its own rapid assessment and gives a different message to its own head office. The assessment teams all go to the same people with the same questions, but come up with different answers.

Kosovo is a good example of lack of coordination. UNICEF is doing immunization, and WFP is bringing in 8000 tons of food a week, but coordination at the field level is poor. Few have asked the people what they want. Scores of NGOs and humanitarian agencies are active in the area affected by the Kosovo crisis. Everyone wants to be there to save lives and be on CNN. Everyone goes to the government. Everyone speaks different languages. Everyone feels they have the mandate. But there is just more confusion and lives are not being saved. If you have to take time to decide who's going to do what, lives are lost.

Coordination starts at home. It should be characterized by excellence, hospitality, and cordiality. It should not include open competition, mistrust, confrontation, hopelessness, friction, or arrogance. Information has to be visible and credible. One network with the positive characteristics just mentioned is the NGO online nutrition network created by Michael Golden (www.ngonut@abdn.ac.uk).

"Coordination starts at home. It should be characterized by excellence, hospitality, and cordiality."

Everything may not go the way organizations want it to, but the bottom line should be that they are there to *do good for the people affected* by the crisis.

Refugee Network Information Service (RNIS)
Arabella Duffield, ACC/SCN

The UN Sub-Committee on Nutrition is responsible for trying to harmonize UN nutrition activities and for locating and funding the RNIS project. This service collects country and regional information on political background, food, security, health, nutrition, trends, causal factors, priorities and recommendations, and situation reports. The RNIS disseminates information to the field, agency headquarters, and donors.

The RNIS was set up in 1993 by a group of people who had observed poor nutrition status and high mortality rates in refugee camps because of inadequate diet. Due to lack of political concern and lack of monitoring, available information was insufficient for people to act, and they needed a central database. The RNIS puts out quarterly reports with updates every six weeks, to raise

awareness, inform decision makers, and advocate for better conditions in refugee camps. The website address is www.unsystem.org//accscn/index.ntme.

The RNIS can help with advocacy by validating other micronutrient surveys and pushing the message to a wide audience, but there are limits to the network's usefulness. Micronutrient data is scarce, and problems are difficult to diagnose. Also, the quality of reporting varies. Do donors read the reports for planning? We don't know. We need data on prevalence, morbidity rates, anecdotal evidence, vulnerability, access to markets, and agricultural potential, among other areas.

* * * * * * *

Discussion Section - Main Points

- Lack of coordination and accountability is the real bottleneck in providing food to people in a timely manner. The people driving the operation are logistics people and accountants, who ignore advice coming from nutritionists.
- The only way to convince decision makers is with hard data, but we don't know enough about successful rapid assessment methodologies. NGOs need to improve assessment skills.
- After an emergency, the influx of NGOs is sometimes so great the government cannot handle them, or competition and turf problems arise. Some NGOs may even be asked to leave or to come back when the immediate emergency is over to do long-term rehabilitation. Unless we pay serious attention to standards and ground rules, each agency will have its own agenda.

Information sources

- The NGO Network runs an informative listserv for nutrition professionals at www.ngonut@abdn.ac.uk. This provides immediate answers and is educational, substantive, and brief.
- The RNIS is better known among European agencies. More input comes from Europe-based organizations and less from U.S.-based agencies working in the field.
- Soon a third information source will provide baseline data. The Health Information Network for Advanced Planning, or HINAP, will be available free of charge on the World Wide Web at www.who.ch/eha/hinap.

* * * * * * *

Partnering with Industry for Better Nutrition and Health
Dr. Shirley Buzzard, Director, CorCom

"CorCom's mission is to stimulate linkages between businesses and non-profit organizations to pursue mutual interests in building economically viable and politically stable communities in developing countries."

The Corporate Community Investment Service (CorCom) was started about three years ago by a group of non-profits that wanted to promote partnerships between non-profits and business. Its mission is to stimulate linkages between businesses and non-profit organizations to pursue mutual interests in building economically viable and politically stable communities in developing countries.

Corporate relations with communities have evolved over the years. Corporations are now interested in investments with both social and business benefits. They want more interaction with the people they are helping. The initial focus was on philanthropy and then strategic philanthropy, but has turned toward community investment and more sustainable projects. Non-profit organizations, on the other hand, are becoming more businesslike, acting like entrepreneurs and moving toward sustainable projects.

CorCom's stated objectives are:

- *to work with businesses as they move beyond philanthropy to strategic community investment*
- *to work with non-profit organizations to help them develop joint ventures with business that meet their social objectives*
- *to serve as a clearinghouse to match businesses with non-profits for joint ventures*
- *to stimulate businesses by linking investors with markets and resources not now being tapped*

The partnership is good for both sides. Non-profit organizations can scale up, incorporate sound business practices, and mobilize new sources of funding free from donor objectives and reporting schedules. For instance, a non-profit may want to work with the elderly, but if such work is not part of USAID's objectives, can't get funding. Working with business is often easier than working with government because there is no time lag in receiving funds. NGO partners can also have some influence over business investments.

Businesses, on the other hand, often don't know how to market their products to poor people. NGOs can help them develop a local identity as being socially and environmentally responsible. They can help anticipate and respond strategically to grassroots sentiments, e.g., about sweatshops and child labor. NGOs can help strengthen the human resource base of the community and leverage financial and other investments in the community, while building up brand awareness.

CorCom activities include training and development. Business and non-profits are two alien cultures, with different values and objectives. CorCom trains non-profits to be more businesslike, i.e., to have corporate statements indicating whom they will deal with and whom they will not (e.g., tobacco companies). CorCom also implements informational activities for businesses. The company acts as a business link center to broker deals, selecting potential partners, helping the two meet, and then coordinating and troubleshooting throughout the relationship. CorCom has a website (www.corcom.org) and holds a series of seminars on special topics. Publications include step-by-step instructions for non-profit organizations on how to engage business partners. CorCom also does consulting to businesses and corporate philanthropy programs. A current program is to encourage companies to make donations to appropriate non-profits for specific emergencies.

We have some challenges ahead. This is a whole new way of doing development work, and the mindset of non-profits has to change at all levels. Right now more businesses than nonprofits are interested in such a relationship. Non-profits are slow to change work at a slower pace than business.

CorCom is working on reconfiguring donor funding to support the new paradigm, getting more venture capital and small start-up grants or loans to get non-profits to enter partnerships. CorCom is also educating business about the work of non-profits.

Eastern Regional Research Center (USDA)
Richard Konstance, Agricultural Research Service, U.S. Department of Agriculture

Scientists at the Eastern Regional Research Center (ERRC) have been working on the development of newly formulated and processed CSB to meet new specifications that include increases in fat content (from 8% to 12%) and increased protein concentration (to 20%). Both the corn and soy portions of the new CSB are processed in a twin-screw extruder, whereby the product is instantized. After drying, grinding, and fortification, the product can be reconstituted into a porridge with room temperature water. In addition to reducing energy requirements for preparation of the porridge, the low temperature reconstitution minimizes degradation of the fortificants. The process provides sufficient heat to inactivate trypsin inhibitors, but allows for a 90% retention of the available lysine that is measured in the raw material.

Based on research at ERRC, recommendations have been made to reduce moisture content specification to 5%. This moisture content is required to minimize oxidative deterioration in storage. Drying studies are now being conducted to determine the conditions of extrusion and drying that maximize moisture reduction while minimizing fat damage. The new product is expected to be slightly more expensive, primarily due to the change in formulation.

Discussion

- Cost analyses are not complete at this stage. Reducing protein to 11% of energy would probably reduce cost significantly. One possibility is to use dairy proteins.
- Instant CSB is created especially for situations where there is no potable water. Less time is lost in cooking and fewer infections are introduced in children. Without potable water, infant formula is already a problem. Even if water is potable, people still have to be told to boil it.
- USDA is studying various grain replacements for countries that eat wheat rather than maize. Wheat seems to be a viable replacement, but any grain or flour source should work. Cost will be the decisive factor.
- SUSTAIN and USAID are working closely with USDA to test the product in the field.

****

Industry Perspective

Note: The invitees and those industry representatives who opted to make presentations are representative of some of the industries involved in relief food and nutritional products. Their participation at this workshop does not represent an endorsement of their companies or products by the workshop organizers or supporters.

Roche Vitamins, Inc.
Ian Newton, Director of Regulatory Affairs and Business Development

Roche is a longtime supporter of basic nutrition around the world. It is a major producer of nutrition ingredients and a leader in the technology to make nutrients stable and bioavailable. Roche provides significant support to academia for basic research, and provides information locally. The company has the capability to supply premixing products globally, and provides nutrients for humanitarian needs. Roche is also founder of the *Sight and Life Program* (www.sightandlife.org).

Some of Roche's global initiatives are:

- Fortification of staple food (wheat, rice, corn, etc.). In sub-Saharan Africa, basic premixes are produced and stocked locally.
- *Sight and Life*, a global program aimed at preventing blindness where vitamin A deficiency exists
- Fortification Basics, a series of information booklets on how to fortify
- application development
- product analysis for nutrient content
- basic science

Roche supports staple food fortification worldwide, with much work done in Latin America. Fortified staples include wheat, sugar, dairy, fats and oils, corn, and school lunches. Wheat is fortified with thiamin, riboflavin, niacin, folate, and iron in most countries. Fortification of sugar with vitamin A is now compulsory in Guatemala, Honduras, and El Salvador. The stability of vitamin A in sugar fortification depends on the right temperatures, humidity, and delivery.

Special support functions include the Applications Laboratory in Nutley, New Jersey, human nutrition research in the U.S. and Switzerland, special developments (rice fortification, premix flowability, analytical assays, etc.), scientific rationale, and sugar fortification. Scientific and nutritional information is shared through a number of publications, including *Scientific Monitor*, *Fortification Basics*, *Nutriview*, *AOV Newsletter*, *HN Science News*, and *Sight and Life Newsletter*. *Scientific Monitor* is available on-line at http://209.133.13.113/nutricao/scimon (U.S.). Issues of *Fortification Basics* include "Wheat Flour" (English and Spanish), "Sugar" (English and Spanish), "Oils and Margarine," "Principles of Assay Procedures," "Choosing a Vehicle," "Stability," and "Maize Flour/Maize Meal."

The *Sight and Life Program* was founded in l986 to help in the fight against vitamin A deficiency in all developing countries. The program is entirely financed by Hoffman/LaRoche and involves no fundraising. An estimated 200 to 300 million children under the age of five are at risk of vitamin A deficiency. Every year 500,000 go blind, most dying within weeks from subsequent infections. Since 1986, the program has supported over a thousand projects in more than 70 countries, and donated 29 million vitamin A capsules, mainly for children between the ages of six months and five years. The program also supports research, technical support, and training and education. Roche's activities take place in Africa (41%), the Americas (21%), and Asia (38%), with a number of international partners and collaborators.

North American Millers Association (NAMA)
Betsy Faga, President

The North American Millers Association, formerly known as Protein Grain Products International, is a non-profit association comprising 44 member companies operating 173 wheat and corn mills in 34 states. Ten of those companies are providing processed grain products for the U.S. Title II program. Of the 21 commodities used in Title II, nine are made by these millers.

When P.L. 480 started in 1954, it was a very basic surplus disposal program that donated wheat flour, bulgur wheat, and cornmeal. In 1966, new legislation authorized the enrichment and fortification of commodities to improve their nutritional value. This was the basis for the development of low-cost, nutritious, high protein grain products. Soy was added to the basic cereal grains to create blended and fortified foods with a complete nutritional profile. These commodities are soy-fortified bulgur, wheat-soy blend, soy-fortified cornmeal, corn-soy blend, instant corn-soy masa flour, and soy-fortified sorghum grits. Although vitamins and minerals were always part of the composition of the blended foods, they were not added to the fortified foods until about twelve years ago. These products were developed to have a bland taste so they would not be diverted to the commercial market, could be adapted to local tastes, and could be readily used with other local products. They are now purchased monthly according to specifications developed by USDA and USAID.

These commodities comprise about 33% of the total U.S. food aid tonnage used in emergency and development programs. Reasons given for not using larger quantities in refugee programs are cost, desired quantities, and timeliness of delivery. Nutritionists in the field often say they need these

"Nutritionists in the field often say they need these nutritional products, while policy makers at headquarters request whole grain commodities to meet a specific tonnage level. . .Producing the best quality product at the best cost to be delivered when needed is a never-ending process for the milling industry."

nutritional products, while policy makers at headquarters request whole grain commodities to meet a specific tonnage level.

Fortification is sometimes harder than it looks. Therefore, the quality of fortification is an important factor in quality assurance. The U.S. milling industry is working closely with USAID and USDA to improve products continually, by studying ways to improve the uniformity and stability of the micronutrients, determining how granulation affects the blending process, researching more stable forms of micronutrients, establishing standards for vitamins and minerals, and assessing milling equipment. The industry is devoting specific attention to a Total Quality Systems Audit program (TQSA) that will test for quality assurance throughout the milling process, rather than testing only the end product. The industry is also looking at programs to pre-position products, which would make processed products more readily available for emergency response and address the concern about timely deliveries. Producing the best quality product at the best cost to be delivered when needed is a never-ending process for the milling industry.

****

Discussion

NAMA has no problem with labeling products for food aid, e.g., date of manufacture. The problem is that commodities go through so many different temperatures and storage times that it is difficult to determine shelf life. If a commodity bears the date of manufacture, people might assume the food product is no longer good. Also, testing methods vary from country to country. However, every bag has a number that indicates when the product was produced. Product specifications are also on the PVO's procurement sheets.

****

Nestlé
Henri Dirren, Head of the Clinical Evaluation Group

Nestlé is a very large food company with a very broad range of products sold all over the world. It does not produce or distribute the basic food commodities that are vehicles for food fortification, with the exception of the Maggi cube. However, many of Nestlé's products, from instant noodle soups in Asia to high-tech clinical nutrition products, are fortified.

Nestlé continues to look for ways to bring micronutrients to people in need through meaningful food fortification. The company carries out research and development activities in the community, including evaluations of the micronutrient status of vulnerable groups and of food intervention strategies. Nestlé's research center has put much effort into improving fortification by better understanding the interaction between the added nutrient and the food matrix, and by optimizing the balance between bio-availability and organoleptic stability of the vehicle. The importance of the organoleptic stability of the food product cannot be stressed enough. Fortification that produces an off-taste or a color change in some recipes will induce consumers to drop the product or shift to other brands, whatever the importance of the added nutrients. And brands are important assets of a company!

The food industry has long experience and wide expertise in food fortification. Developing collaboration between relief agencies and industry can only speed up the process of enhancing nutritional quality of relief diets.

The Use of Dry Beans in Humanitarian and Other Food Assistance Programs
Nina Schlossman, Representative, National Dry Bean Council

Beans are produced across the United States, with fifteen states producing the bulk of the 1 to 1.4 million metric ton annual yield. Food aid sales are an important market for the bean industry. In 1997 and 1998, 26,000 MT of beans were used in P.L. 480 Title II
food aid programs. Edible beans are a major source of protein, folate, B vitamins, and iron, and thus provide a natural source of these micronutrients when part of the food aid basket.

Many different kinds of pulses are available from the U.S., including beans, lentils and peas. People in different parts of the world have strong preferences for specific varieties of pulses, based on size, color, taste, and cooking characteristics. Refugees and other recipients of humanitarian assistance are especially glad to get familiar foods, such as their preferred beans – a little taste of home!

The National Dry Bean Council (NDBC), an association representing growers and sellers, provides samples, nutritional information, and a list of exporters. Since the USAID Commodities Reference Guide (CRG) for PVOs did not include any information specific to dry beans or their varieties, NDBC developed Dry Bean Fact Sheets and a Guide for PVOs on using beans in food aid programs. The 1999 revision of the CRG and web version now include fact sheets on eight different bean varieties so that appropriate varieties can be ordered for specific countries.

An issue that keeps coming up in emergency situations is the time it takes to prepare beans. People don't have time to cook, beans are not digestible for children unless mashed, and the fuel and water requirements affect the environment. Some companies in Europe pre-cook beans, which reduces cooking time to 45 minutes. But cultural preferences and contexts have to be considered.

Food aid programs have expressed interest in exploring processed beans, such as dehydrated beans, bean flour, and beans that can be sprouted (e.g., mung beans). NDBC would welcome the opportunity to work with PVOs in field projects to field test such value-added products and approaches.

MedPharm
Andy Kovall, President

MedPharm is a generic pharmaceutical company that produces micronutrients and multivitamins in capsule and powder form on a cost-effective basis. As an example of

what MedPharm does, the drug of choice for children's intestinal parasites used to have to be taken five times a day. This simply was not appropriate in the field in developing countries, so MedPharm came up with a single dose treatment that was chewable and peppermint flavored. This treatment is easier in relief situations as well.

One billion children are affected by parasites in areas where emergencies and starvation occur. Worms can consume 15% to 25% of the food children ingest, thus creating a loss on the investment to improve nutritional status. This loss can be reduced by de-worming children. This is a very real cost with a very thin profit, but the benefits are clear. MedPharm can provide a de-worming drug for less than ten cents a year per child and recommends that de-worming be a part of all child survival programs.

****

Workshop Concluding Remarks

The elimination of vitamin A deficiency and iodine deficiency disorders and the reduction of iron deficiency anemia have been endorsed as achievable goals by almost all countries represented at the International Conference on Nutrition (1992). These goals are similar for refugee populations. Around the world, refugee and displaced populations are on the rise. Along with this trend has come an alarming increase in malnutrition and mortality. Displaced populations make up a substantial part of the total number of malnourished persons. It has been well demonstrated that malnutrition and morbidity can be controlled with external assistance. Although the international community has made progress in controlling the nutrition situation in relief and transition settings, gaps remain in the provision of adequate and quality food in a timely matter. One answer to this is fortification of staple food, the most cost-effective and sustainable way to treat micronutrient malnutrition. Fortification technologies can and should be applied in relief settings as a way to address micronutrient malnutrition. This workshop brought to light some of the possibilities for improving relief diets, including fortifying relief foods, staple foods, and condiments in a variety of settings; adding micronutrient-rich seed packets to rations; promoting trade of relief foods; and increasing diet diversity overall.

What we do now, in the immediate future, and in the coming years to address the serious and persistent problem of malnutrition among refugee populations is up to all of us. It is up to governments to support policies, research, and relief organizations. It is up to industry to devise a longer shelf life for foods and to fortify foods with multinutrients. It is up to the international relief community and field agencies to be better prepared for predictable deficiencies, to promote the value of diet diversity, and to deliver a better variety of quality foods to vulnerable refugee populations. Only increased awareness and cooperation among governments, relief agencies, the food industry, agriculture, academia, and international bodies will make this happen.

Appendices

Appendix A. Workshop Agenda

Enhancing the Nutritional Quality of Relief Diets Workshop

April 28-30, 1999

American Red Cross Board of Governors Hall
17th and D Streets NW, Washington, DC

This workshop is designed to exchange information on how the nutritional quality of relief diets can be enhanced at regional and local levels. The focus will be on improving micronutrient content, although other factors will be considered. There are many options for improving nutritional quality of diets, and this workshop will weigh some of these. Where applicable, workshop presenters will draw on progress made in the "development" context and make linkages to the 'relief' context. The target audience is field implementers.

Workshop Goals:

1) Exchange information on current practices, and compare operational approaches, in enhancing nutritional quality of relief foods, especially micronutrients.

2) Explore opportunities to implement small-scale/medium-scale fortification at local and regional levels, as well as issues of administration, quality control, costs, and longer-term sustainability.

Workshop Outputs:

1) Recommendations for follow up discussions and field testing of different options for fortification field activities, based on the examples and experiences of the workshop

2) Strengthening of a network of agencies to exchange information on an ongoing basis

3) Compilation of key resources for enhancing relief diets

4) Presentation of recommendations for action that may have policy and/or research implications

5) Publication of well-documented workshop proceedings that provides information to field staff on current practices and experiences, along with summaries of discussions from the workshop, background papers, and an annotated bibliography

Day 1: Wednesday, April 28, 1999

8:30 Opening Welcome
American Red Cross

Workshop objectives
Dan Shaughnessy/Council for Responsible Nutrition

Introduction of participants

PART I: HISTORY OF EFFORTS TO ENHANCE THE NUTRITIONAL QUALITY OF RELIEF FOODS

9:30 *Summary of malnutrition in emergencies*
Dr. John Mason/Tulane University

10:00 *Alleviating micronutrient malnutrition in relief settings and overview of nutrition standards*
Rita Bhatia/UNHCR

10:30 Break

10:45 *Analysis of major programmatic options to address nutritional deficiencies in emergency operations*
Dr. George Beaton/University of Toronto

11:00 *Practical approaches and methods to meet nutritional adequacy*
Overview: Dr. Michael Golden/University of Aberdeen, Scotland, UK

11:15 Plenary discussion
Moderators: Drs. George Beaton and Michael Golden

11:45 *P.L. 480 Title II Food Aid: Aan overview of issues and progress in enhancing program foods*
Dr. Tom Marchione/USAID/BHR/PPE

12:15 Lunch

PART II: METHODS TO IMPROVE NUTRITIONAL CONTENT OF RELIEF DIETS

1:15 Group panel: *Options for food fortification in relief settings: practice, potential and challenges*
Moderator: Jenny Cervinskas/The Micronutrient Initiative

A) General introduction to food fortification in relief, drought, and transition situations
Dr. George Beaton/University of Toronto

B) Comparing options for getting micronutrients to relief populations: Royal Tropical Institute (KIT) Experience in Africa
Willem Wurdemann/KIT, Netherlands

2:00 Discussion

2:15 *C) The full range of fortifying cereal commodities*

Fortifying the staple: brief case study of the Zimbabwe drought 1992-1994: exploration of options to improve micronutrients
Judith Mutumba/ Ministry of Health, Zimbabwe

INCAP/OPS's response—Hurricane Mitch
Dr. Florence Tartanac/Instituto de Nutrición de Centro América y Panamá (INCAP/OPS)

1) Fortifying staples

Going into the issues: industry, establishing networks, developing the technology, quality assurance, costs
Quentin Johnson/Consultant to The Micronutrient Initiative

The case of fortifying flour: differences of scale—at port, regional, local, at the camp
Quentin Johnson/Consultant to The Micronutrient Initiative

Old and new technologies for small scale fortification (e.g. barrel batch mixers, hand held mills, dosing equipment)
Dr. Louis Laleye/The Micronutrient Initiative

Case study, Malawi: maize flour—village hammer mill
Neal Hammond/SUSTAIN Volunteer

3:45 Break

4:00 *2) Fortification via blended foods*

Fortification of maize and complementary food: a case study from Malawi
Alison Tweeddale and Theresa Banda/World Vision/Canada

D) Options for nutritional improvement of non-grain relief commodities

1) Fortified condiments: salt
Dr. John Dunn/University of Virginia

Plenary discussion
Open exchange on relevant fortification field experiences
Moderator: Jenny Cervinskas/The Micronutrient Initiative

5:00 Summary
Dr. John Mason/Tulane University

5:30 Wine and cheese reception (sponsored by International Life Sciences Institute and Breedlove Dehydrated Foods) at the American Red Cross Museum

Day 2: ***Thursday, April 29, 1999***

8:30 Welcome and objectives for the day
Dan Shaughnessy/Council for Responsible Nutrition

PART II: METHODS TO IMPROVE NUTRITIONAL CONTENT OF RELIEF DIETS (continued)

8:45 *D) Options for nutritional improvement of non-grain relief commodities*

2) Fortified condiments: Sugar
Dr. Florence Tartanac/INCAP/OPS

Micronutrient Sprinkles: Research results and the potential for relief settings
Dr. Stanley Zlotkin/University of Toronto

3) Fortified oil: opportunities for vitamin A-fortified vegetable oil
Peter Ranum/SUSTAIN Volunteer

9:45 Plenary discussion
Jose Mora/The MOST Project

10:15 Break

10:30 *Overall quality assurance in food fortification*
Dr. Fritz van de Haar/PAMM-Emory University

The potential of amylase-fortified cereals in relief settings
Dr. Noel Vietmeyer/formerly with the National Academy of Sciences

11:00 *Role of specialty foods*
Steve Hansch/Congressional Hunger Center

11:30 Plenary discussion
Moderator: Dr. George Beaton/GHB Consulting

12:00 Lunch
Informational displays (ARC/BOG Hall)

2:00 Break-out groups

Group A: Regional Fortification
Objective: Examine how techniques that improve the nutritional content of foods can be introduced or reinforced at regional levels. Can the introduction of fortification or enrichment technologies in emergency-affected countries help promote good nutritional practices in the long term? Do they have the potential to address micronutrient needs of larger numbers of people?

Group B: Agricultural Approaches
Objective: Determine the extent to which food-based programs can improve the nutritional quality of diets. When can household gardens and seed distribution be effective in improving the consumption of vitamins and

minerals? What is the effective coverage of the population? What are the timelines or delays involved? What are the long-term benefits, for example, in terms of demonstration and education? What has been the experience with using Amylase-fortified foods and other technical inputs in extreme settings, and how readily can these options and other innovations be provided to emergency-affected populations?

Group C: Food Aid from Donor Countries
Objective: Explore ways donor-country-level fortification of foods can better mitigate deficiencies that have until now recurred in emergencies. What are the technical and cost implications? How can the Commodity Reference Guide specifications clarify the options for implementing agencies?

Group D: Supplements and Problem Nutrients
Objective: Contrast approaches to addressing the specific problems of vitamin C, iron, and zinc, which are among the most difficult nutrients to provide in emergencies. Is it worthwhile to add vitamin C to relief foods and, if so, to which foods and how? What are the advantages and disadvantages of nutritional supplements, including multivitamin capsules, in extreme circumstances? How does the distribution of vitamin A capsules, an established priority, relate to the emphasis on vitamin A as a food fortificant on an ongoing basis? For iron and zinc, what can be achieved through the three levels of programming: fortificants, food-based, or supplements?

Group E: Development of Field Activity
Objective: Elaborate pilot programs for development, comparing the latest approaches proposed at this conference in terms of applicability, effectiveness, and replicability. What local or regional measures might add a broad spectrum of micronutrients to bulk rations? In particular, what set of field interventions feasible/effective in an area like Southern Sudan can NGOs work together to implement in the short term? What common methods need to be standardized to ensure comparability of results across projects?

Group F: Recipient Dietary Needs/Ration Planning
Objective: Review the fit among factors that need to be taken into account when planning an overall food plan for an emergency-affected population. Given uncertainties in food delivery and the historical pattern of deficiency diseases in crises, what measures are appropriate to schedule ration foods, provide balance with fortified foods, and introduce fresh foods in affordable quantities?

5.30 Summary/Housekeeping

Appendix B. List of Participants

Saade Abdallah
Research Assistant
IFRC/Hopkins Project
Johns Hopkins School of Public Health
615 N. Wolfe Street
Baltimore, MD 21205
T: (410) 614-3948
F: (410) 614-1419
E: sabdalla@jhsph.edu

Khawaja M. Adeeb
Coordinator for Technical Assistance
CARE
Commodity Management, PHLS Unit
151 Ellis Street
Atlanta, GA 30303
T: (404) 681-2552 x 358
F: (404) 577-1205 or 6662
E: adeeb@care.org

Dr. Laurie Aomari
IVACG Project Manager
IVACG Secretariat
ILSI Human Nutrition Institute
1126 Sixteenth Street NW
Washington, DC 20036-4810
T: (202) 659-9024
F: (202) 659-3617
E: LAomari@ilsi.org

Theresa Banda
National Micronutrient Coordinator
Ministry of Health and Population
P.O. Box 30377
Lilongwe 3
Malawi, AFRICA
T: (265) 831746 cell (265) 783044
W: (265) 740110 (H)
F: (265) 783109/780513

Dr. George Beaton
GHB Consulting
9 Silverview Drive
Willowdale, Ontario
CANADA, M2M 2B2
T: (416) 221-7409
F: (416) 221- 8563
E: g.beaton@utoronto.ca

Roy Beery
Marketing Consultant
Breedlove Dehydrated Foods
1818 No. MLK Blvd.
Lubbock, TX 79403
T: (806) 741-0404
F: (806) 741-0447
E: roybeery@breedlove.org

Sharon Cramer Bell
Consultant
2542 Coralwood Drive
Decatur, GA 30033
T/F: (404) 633-2705
E: sharonbell@mindspring.com

Angela Berry
Senior Adviser
Office of Emergency Programmes
UNICEF House, Room 286
Three United Nations Plaza
NY, NY 10017
T: (212) 326-7464
F: (212) 326-7037
E: aberry@unicef.org

Rita Bhatia
Senior Nutritionist
United Nations High Commissioner for Refugees
Case Postale 2500
CH-1211 Geneva 2 Depot
T: (41-22) 739-8308
F: (41-22) 739-7366
E: Bhatia@unhcr.ch

Rachel A. Bird Anderson
Division of Humanitarian Response
Save the Children
1620 I Street, NW - Suite 202
Washington, DC 20006
T: (202) 530-4393
F: (202) 293-4167
E: rbirdand@dc.savechildren.org

Dr. Patricia Bonnard
Consultant
PO Box 21288
Washington, DC 20009
T/F: (202) 797-8665
E: pb@cais.com

Shirley Buzzard
Director
Corporate Community Investment Service (CorCom)
1313 22nd Street, NW
Washington, DC 20037-3007
T.: (202) 296-7638
F: (202))785-0216
E: info@corcom.org

Jean Meyers-Capps
Consultant
ADRA International Headquarters
12501 Old Columbia Pike
Silver Spring, MD 20904-6600
T: (301) 680-6390
F: (301) 680-6370
E: jcapps@erols.com

Thoric Cederstrom
Food Security Policy Advisor
Save the Children/USA
1620 I Street NW - Suite 202
Washington, DC 20006
T: (202) 530-4393
F: (202) 293-4167
E: tcederstrom@dc.savechildren.org

Dr. Jindra Cekan
Food Security Advisor
Catholic Relief Services
209 Fayette Street
Baltimore, MD 20201
T: (410) 625-2220 ext 3454
F: (410) 234-3176
E: Jcekan@catholicrelief.org

Dr. Jenny Cervinskas
Programme Coordinator
The Micronutrient Initiative
P O Box 8500
250 Albert Street
Ottawa, Ontario
CANADA, K1G 3H9
T: (613) 236- 6163 ext 2262
F: (613) 236- 9579
E: jcervinskas@idrc.ca

Dr. Eunyong Chung
USAID/G/PHN/HN/NMH
RRB 3.07-055
1300 Pennsylvania Avenue NW
Washington, DC 20523-3700
T: (202) 712-4786
F: (202) 216-3702
E: echung@usaid.gov

Liliana Riva Clement, MPH
Consultant/IEF Representative
261 S. 24th Street
Philadelphia, PA 19103
T: (215) 735-3564
F: (215) 735-3547
E: lily1@mindspring.com

Dr. Bruce Cogill, Ph.D.
Project Director
FANta/AED
1825 Connecticut Avenue NW
Washington DC 20009-5721
T: (202) 884- 8722
F: (202) 884- 8432
E: bcogill@aed.org
Website: fantaproject@aed.org

Dr. Kristy Cook
Food Security Advisor
USAID/AFR/SD and USDA/FAS/IDC
1325 G Street NW, Suite 400
Washington, DC 20005
T: (202) 219-0451
F: (202) 219-0508
E: kcook@afr-sd.org

Dr. Frances R. Davidson
USAID/G/PHN/HN/CS
1300 Pennsylvania Avenue NW
Washington, DC 20523-3700
T: (202) 712-0982
F: (202) 216-3702
E: fdavidson@usaid.gov

Agnès Dhur
Agro-nutritionist
ICRC (International Committee of the Red Cross)
19 avenue de la Paix
CH 1202 Geneva, SWITZERLAND
T: (41-22) 730-2510
F: (41-22) 733-9674
E: adhur@icrc.org

Dr. Henri M. Dirren
Head, Clinical Evaluation Group
Nestlé Research Center
P.O. Box 44
Vers-chez-les-Blancs
1000 Lausanne 26, SWITZERLAND
T: (41-21) 785- 8624
F: (41-21) 785-8925
E: hernri.dirren@rdls.nestle.com

Nancy Drost, Ed.D.
Programme Development
Health, Nutrition and Gender
CARE Canada
CP/PO Box 9000, 6 Antares
Ottawa, Ontario K1G 4X6
CANADA, KIG 4X6
T: (613) 228-5608
F: (613) 226-5777
E: ndrost@care.ca

Arabella Duffield
Refugee Nutrition Informtn.Coordinator
UN Sub-Committee on Nutrition (ACC/SCN)
World Health Organization
20 Avenue Appia
Geneva 1211, SWITZERLAND
T: (41-22) 791-0456
F: (41-22) 798-8891
E: accscn@who.ch; Duffielda@who.int

Dr. John T. Dunn
Professor of Medicine
Secretary, ICCIDD
University of Virginia
Box 511, HSC, UVA
Charlottesville, VA 22908
T: (804) 924-5929
F: (804) 296-9275
E: Jtd@virginia.edu

Betsy Faga
President
North American Millers' Association
600 Maryland Avenue, SW, #305W
Washington, DC 20024
T: (202) 484-2200 ext. 104
F: (202) 488-7416
E: betsyfaga@aol.com

Margie Ferris-Morris
Food Security and Nutrition Consultant
FMA, Inc.
6360 Lyric Lane
Falls Church, VA 22044
T/F: (703) 642-2536
E: fma@dc.net

Prof. Michael H.N. Golden
Dept. of Medicine and Therapeutics
Univ. of Aberdeen, Foresterhill
AB9 2ZD, Scotland, UK
T: 44 (1224) 681- 818 ext 52793/53014
T: 44 (1224) 663 -123 (direct)
F: 44 (1224) 699 884
E: m.golden@abdn.ac.uk

Jessica Graef
Technical Information Specialist
Food Aid Management
300 I Street NE, Suite 212
Washington, DC 20002
T: (202) 544-6972
F: (202) 544-7065
E: jgraef@foodaid.org

Sylvia R. Graves
Program Analyst/ Development Programs Coordinator
Office of Food for Peace, RRB, 7th Floor
300 Pennsylvania Avenue NW
Washington, DC 20523-3700
T: (202) 712-4424
E: sygraves@usaid.org

Paul B. Green
North American Millers' Association
600 Maryland Avenue SW, #305W
Washington, DC 20024
T: (202) 484-2200 ext. 106
F: (202) 488-7416
E: pbgreen@aol.com

Alison Greig
The Micronutrient Initiative
P O Box 8500
250 Albert Street
Ottawa, Ontario
CANADA, K1G 3H9
T: (613) 236- 6163 ext 2262
F: (613) 236- 9579
E: agreig@idrc.ca

Dr. Neal Hammond
Volunteer
SUSTAIN
1400 16th Street NW
Box 25, Washington, DC 20036
T: (202) 328-5180
F: (202) 328-5175
E: Nhammon1@ix.netcom.com

Steven Hansch
International Humanitarian Affairs Coordinator
Congressional Hunger Center
229 ½ Pennsylvania Avenue SE
Washington, DC 20003
T: (202) 547-7022
F: (202) 547-7575
E: Shansch@bellatlantic.net

Cassandra Hardge
Program Officer
Commodity Management, PHLS Unit
151 Ellis Street
Atlanta, GA 30303
T: (404) 681-2552
F: (404) 577-1205 or 6662
E: hardge@care.org

Mohamed Haroun
Islamic African Relief Agency.
P.O.Box 7090
Kampala, UGANDA
T: 00256-41-268346/077507031
F: 00256-41-268346/345580
E: iara@swiftuganda.com

Paige Harrigan
Food Aid Management
300 I Street NE, Suite 212
Washington, DC 20002
T: (202) 544-6972
F: (202) 544-7065
E: pharrigan@foodaid.org

Dr. Suzanne Harris
IVACG Secretariat
ILSI Human Nutrition Institute
1126 Sixteenth Street, NW
Washington, DC 20036-4810
T: (202) 659-9024
F: (202) 659-3617
E: suzie@dc.ilsi.org

Dr. Virgina Holsinger
Research Leader
Dairy Products Research Unit
USDA/ARS/NAA/ERRC
600 E. Mermaid Lane
Wyndmoor, PA 19038
T: (215) 233-6703
F: (215) 233-6795
E: vholsinger@ARSERRC.Gov

Dr. Sandra Huffman
Ready to Learn/AED
1825 Connecticut Avenue NW
Washington, DC 20009
T: (301) 986-1046
F: (301) 986-1364
E: shuffman@aed.org

Dr. David Hughes
Independent Consultant
2338 Blaine Drive
Chevy Chase, MD 20815
T: (301) 585-4051
F: (301) 585-4051
E: hughes077@earthlink.net

Kamal Hyder
The MOST Project/ISTI
1820 N. Fort Meyer Drive, Suite 600
Arlington, VA 22209
T: (703) 248-3321
F: (703) 807-0278
E: khyder@istiinc.com

Quentin Johnson
Consultant
RR #4
Rockwood, Ontario
CANADA, NOB 2KO
T: (519) 856-2364
F: (519) 856-1101
E: quentin@quican.com

Gerald Jones
Director
International Service Dept.
American Red Cross
1601 N. Kent Street, 2nd floor
Arlington, VA 22209
T: (703) 465-4800
F: (703) 465-4853

Dr. Samuel Kahn
Senior Health Nutrition Advisor
USAID/G/PHN/HN/NMH
RRB 3.07-043
1300 Pennsylvania Avenue NW
Washington, DC 20523-3700
T: (202) 712-0785
F: (202) 216-3702
E: skahn@usaid.gov

Bill & Mary Louise Kingsberg
Breedlove Dehydrated Foods
4612 Locust Avenue
Lubbock, TX 79403
T: (806) 763-3003
F: (806) 741-0850
E: spfb@llano.net

Richard Konstance
Research Chemical Engineer
Dairy Products Research Unit
USDA/ARS/NAA/ERRC
600 E. Mermaid Lane
Wyndmoor, PA 19038
T: (215) 233-6600
F: (215) 233-6559
E: rkonstance@ARSERRC.Gov

Andy Koval
MedPharm
1776 K Street NW
Washington, DC 20006
T: (202) 452-7996
F: (202) 452-6041
E: medpharm@erols.com

Dr. Louis Laleye
Director Technology & Research
The Micronutrient Initiative
250 Albert Street
Ottawa, Ontario
CANADA, K1G 3H9
T: (613) 236-6163 Ext. 2194
F: (613) 236-9579
E: llaleye@idrc.ca

Sue Lautze
Director, Livelihoods Initiative Program
Feinstein International Famine Center
School of Nutrition, Science and Policy
Tufts University
Medford, MA 02155
T: (617) 627-3423
F: (617) 627-3428
E: slautze@infonet.tufts.edu

Rebecca A. Lee
Agricultural Marketing Specialist
USDA, Farm Service Agency
Procurement and Donations Division
Room 5756-S, Stop 0551
1400 Independence Avenue SW
Washington, DC 20250-0551
T: (202)690-2534
F: (202) 690-1809
E: Rebecca_Lee@wdc.fsa.usda.gov

Dr. Carol Levin
Economics/Sustainability Advisor
The MOST Project/ISTI
1820 N. Fort Meyer Drive, Suite 600
Arlington, VA 22209
T: (703) 248-3314
F: (703) 807-0278
E: clevin@istiinc.com

Michelle Loosli
Corporate Community Investment
Service (CorCom)
1313 22nd Street, NW
Washington, DC 20037-3007
T: (202) 296-7638
F: (202) 785-0216
E: info@corcom.org

Teresa Lozeau
Program Manager
SUSTAIN
1400 16th Street NW, Box 25
Washington, DC 20036
T: (202) 328-5180
F: (202) 328-5175
E: tlozeau@sustaintech.org

Kristen L. Marsh
Nutrition and Maternal/Child Health Technical Advisor
USAID, Global Bureau
1300 Pennsylvania Avenue NW
Washington DC 20523-3700
T: (202) 712-1042
F: (202) 216-3702
E: kmarsh@usaid.gov

Judith R. Mutamba
E. & S. Africa Sub-Reg. Coordinator
ICCIDD
c/o Ministry of Health & Child Welfare
Box CY 1122, Causeway
Harare, ZIMBAWE
T: (263) 4 79-1169
F: (263) 4 79-2 154
E: jmutamba@healthnet.zw; jmutamba@africaonline.co.zw

Dr. Mary S. Lung'aho
Sr. Technical Advisor for Emergency Health/Nutrition
Catholic Relief Services (CRS)
Program Quality Support Department (PQSD)
209 West Fayette Street
Baltimore, MD 21201-3443
T: (410) 625-2220, ext. 3464
F: (410) 234-3189 (include PQSD on address)
E: mlungaho@catholicrelief.org

Sheryl Martin
Workshop Coordinator
Food Aid Management
300 I Street NE, Suite 212
Washington, DC 20002
T: (202) 544-6972
F: (202) 544-7065
E: sherylmart@aol.com

Joe Nasr
Vice President
The Urban Agriculture Network Inc.
1711 Lamont Street NW
Washington, DC 20010-2601
T: (202) 483-8130
F: (202) 986-6732
E: urbanag@compuserve.com

Dr. Thomas J. Marchione
Evaluation Officer and Nutrition Advisor
USAID/BHR/PPE
RRB 8.06-098
1300 Pennsylvania Avenue NW
Washington, DC 20523-3700
T: (202) 712-1645
F: (202) 216-3385
E: tmarchione@usaid.gov

Margaret McGunnigle
Programs Manager
SUSTAIN
1400 16th Street NWm Box 25
Washington, DC 20036
T: (202) 328-5180
F: (202) 328-5175
E: mmcgunnigle@sustaintech.org

Ian Newton
Director of Regulatory Affairs and Business Development
Roche Vitamins Inc.
45 Waterview Boulevard
Parsippany, NJ 07054
T: (973) 257-8326
F: (973) 257-8414
E: ian.newton@roche.com

Prof. John Mason
School of Public Health and Tropical Medicine
Department of International Health and Development
Tulane University
1440 Canal Street, Suite 2200
New Orleans, LA 70112
T: (504) 584-3655
F: (504) 584-3653
E: masonj@mailhost.tcs.tulane.edu

Mary Mogga
Program Coordinator
Cooperative Extension Program
Tennessee State University
5565 Shelby Oaks Drive
Memphis, TN 38134
T: (901) 544-0243
O: (901) 384-8645
F: (901) 544-0247 (office)
E: Mkmogga@aol.com

Dr. Ritu Nalubola
Food Science Advisor
The MOST Project/ISTI
1820 N. Fort Myer Drive, Suite 600
Arlington, VA 22009
T: (703) 248-3323
F: (703) 807-0278
E: rnalubola@istinc.com

Jennifer Masse
Program Associate
SUSTAIN
1400 16th Street NW, Box 25
Washington, DC 20036
T: (202) 328-5180
F: (202) 328-5175
E: jmasse@sustaintech.org

Dr.Jose Mora
The MOST Project/ISTI
1820 N. Fort Meyer Drive, Suite 600
Arlington, VA 22209
T: (703) 807-0236
F: (703) 807-0278
E: jmora@istiinc.com

Marc Nosbach
Division of Humanitarian Response
Save the Children
1620 I Street NW, Suite 202
Washington, DC 20006 USA
T: (202) 530-4393
F: (202) 293-4167
E: mnosbach@dc.savechildren.org

Charles I. Onwulata
Research Food Technologist
USDA/ARS/ERRC
600 East Mermaid Lane
Wyndmoor, PA 19038
T: (215) 233-6497
F: (215) 233-647
E: conwulata@arserrc.gov

Peter Ranum
Senior Project Advisor
SUSTAIN
1400 16th Street, NW, Box 25
Washington, DC 20036
T: (202) 328-5180
F: (202) 328-5175
E: doughmaker@aol.com

Dr. Andrew Seal
Researcher in Public Health Nutrition
Centre for International Child Health
Institute of Child Health
30 Guilford Street
LONDON WC1N 1EH
T: 44 (0) 171 242-9789 ext. 2468
F: 44 (0) 171 404-2062
E: a.seal@ich.ucl.ac.uk

Dr. Ibrahim Parvanta
Chief, International Activities
Maternal and Child Nutrition Branch
Division of Nutrition and Physical Activity
CDC, Mailstop K-25
4770 Buford Highway, N.E.
Atlanta, GA 30341
T: (770) 488-5865
F: (770) 488-5369
E: ixp1@cdc.gov

Terrence J. Ryan
Director
Food Aid Management
300 I Street NE, Suite 212
Washington, DC 20002
T: (202) 544-6972
F: (202) 544-7065
E: Tryan@foodaid.org
Website: www.foodaid.org

Dan Shaughnessy
Vice President
Council for Responsible Nutrition
1875 Eye Street NW, Suite 400
Suite 400
Washington, DC 20006-5409
T: (202) 872-1488
F: (202) 872-9594
E: dshaugh@crnusa.org

Donna Porter
LC-CRS-SWM 413
Library of Congress
Specialist in Life Sciences
T: (202) 707-7032
F: (202) 707-7000
E: dporter@crs.loc.gov

Bryn Sakagawa, MIM, MPH
Student
Johns Hopkins University
45 East Fort Avenue
Baltimore, MD 21230
T: (410) 783-4242
E: bsakagaw@jhsph.edu

Jac Smit
President
Urban Agriculture Network Inc.
1711 Lamont Street NW
Washington, DC 20010-2601
T: (202) 483-8130
F: (202) 986-6732
E: urbanag@compuserve.com

Dr. Tim Quick
Micronutrient Research & Program Advisor
USAID Office of Health & Nutrition
1300 Pennsylvania Avenue NW
Washington, DC 20523-3700
T: (202) 712-0974
F: (202) 216-3702
E: tquick@usaid.gov

Dorothy Scheffel
Food Resources Officer
World Vision
200 I Street NE
Washington, DC 20002
T: (202) 547-3743
F: (202) 547-4834
E: dscheffe@worldvision.org

Dr. James C. Smith, Jr.
Research Chemist
USAD, ARS, BA/BHNRC
Building 307, Room 323, BAR-EAST
Beltsville, MD 20705
T: (301) 504-8383
F: (301) 504-9456
E: smith@307.bhnrc.usda.gov

Serena Rajabuin
Maternal/Child Health Specialist
FANta Project/AED
1825 Building
1825 Connecticut Avenue NW
Washington, DC 20009-5721
T: (202) 884-8000
F: (202) 884-8413 or 202-884-8709
E: Srajabiu@aed.org

Jane Schmitz
Program Assistant
FANta/AED
1825 Connecticut Avenue NW
Washington DC 20009-5721
T: (202) 884-8000
F: (202) 884-8413 or 202-884-8709
E: jschmitz@aed.org

Margaret Stansberry
American Red Cross
International Service Dept
1601 N. Kent Street, 2nd floor
Arlington, VA 22209
T: (703) 465-4800
F: (703) 465-4853
E: stansbem@usa.redcross.org

Dr. Anne Ralte
MCH/Emergency Programming Specialist
FANta Project/AED
P.O. Box 15053
Arlington, VA 22215
T: (703) 416-1659
F: (703) 416-1659
E: raltea@earthlink.net

Dr. Nina P. Schlossman
President,
Global Food & Nutrition Inc.
9914 Woodburn Road
Silver Spring, MD 20901
T: (301) 593-0624
F: (301) 593-0255
E: nschlossman@ids2.idsonline.com

Erica Stewart
Program Associate
SUSTAIN
1400 16th Street NW, Box 25
Washington, DC 20036
T: (202) 328-5180
F: (202) 328-5175
E: Estewart@sustaintech.org

Bob Stotz
Survivor Industries, Inc.
2585 Azurite Circle
Newbury Park, CA 91320
T: (805) 498-6062
F: (805) 499-3708
E: survivorind@msn.com

Doris Teasley
Research Products Company
Division of McShares, Inc.
P.O. Box 1460
Salina, KS 67402-1460
T: (785) 825-2181
F: (785) 825-8908
E: RPCSAL@aol.com

Howard Wallace
President
Survivor Industries, Inc.
2585 Azurite Circle
Newbury Park, CA 91320
T: (805) 498-6062
F: (805) 499-3708
E: survivorind@msn.com

Elizabeth D. Strange
Research Chemist
Eastern Regional Research Center,
Dairy Products
600 E. Mermaid Lane
Wyndmoor, PA 19038
T: (215) 233-6517
F: (215) 233-6795
E: estrange@arserrc.gov

Elizabeth Turner
Executive Director
SUSTAIN Box 25
1400 16th Street NW
Washington, DC 20036
T: (202) 328-5180
F: (202) 328-5175
E: lturner@sustaintech.org
Website; www.sustaintech.org

John Watson
President
Watson Foods Company, Inc.
301 Heffernan Drive
West Haven, CT 06516
T: (203) 932-3000 ext. 3024
F: (203) 932-8266

Caroline Tanner
Aga Khan Foundation
1901 L Street NW, Suite 700
Washington, DC 20036-3506
T: (202) 293-2537
F: (202) 785-1752
E: 71075.1561@compuserve.com

Alison Tweeddale
Nutrition Team
International Programs Division
World Vision/Canada
6630 Turner Valley Road
Mississauga, Ontario
CANADA, L5N 2S4
T: (905) 821-3033, ext. 3402
F: (905) 821-1825
E: alison_tweeddale@worldvision.ca

David Weaver, JR
Executive Director
Breedlove Dehydrated Foods
4612 Locust Avenue
Lubbock, TX 79404
T: (806) 763-3003
F: (806) 741-0850
E: spfb@llano.net

Dr. Florence Tartanac
Unidad de Agroindustria
Institute de Nutrition de Centro America
y Panamá (INCAP/OPS)
Calzada Roosevelt, Zona 11
Apartado Postal 1188
GUATAMALA, C.A.
T: (502) 471-5655 al 59
(502) 472-3762 al 66
F: (502) 473-6529
E: ftartana@incap.org.gt

Dr. Frits van der Haar
Technical Director
PAMM - Program against Micronutrient
Malnutrition
Department of International Health
Rollins School of Public Health of
Emory University
1518 Clifton Road, NE-7th Floor
Atlanta, GA USA 30322
T: (404) 727-4553
F: (404) 727-4590
E: fvander@sph.emory.edu
E: pammusa@sph.emory.edu

Anna Winoto
Project Assistant
The MOST Project/ISTI
1820 N. Fort. Myer Drive, Suite 600
Arlington, VA 22209
T: (703) 807-0236
F: (703) 807-0278
E: awinoto@istiinc.com

Robert Taylor
General Manager
Breedlove Dehydrated Foods
1818 No. MLK Boulevard
Lubbock, TX 79403
T: (806) 741-0404
F: (806) 741-0447
E: roberttaylor@breedlove.org

Dr. Noel Vietmeyer
5921 River Drive
Lorton, VA 22079
T: (703) 339-6161
E: Nviet@aol.com

Dr. Bradley A. Woodruff, MPH
Medical Epidemiologist
Centers for Disease Control and
Prevention
CDC, Mailstop F-48
4770 Buford Highway
Atlanta, GA 30341
T: (770) 488-3523
F: (770) 488-7829
E: baw4@cdc.gov

Dr. Willem Wurdemann
Royal Tropical Institute (KIT)
Department of Agriculture and
Enterprise Development
P.O.B. 95001
1090 HA Amsterdam
NETHERLANDS
T: 31 - (0) 20 - 56 88 491
(direct)/ 56 88 234 (secr.)
F: 31 - (0) 20 - 56 88 498
E: w.wurdemann@kit.nl

Lee Yerkes
Public/Private Sector Advisor
The MOST Project/ISTI
1820 N. Fort Meyer Drive, Suite 600
Arlington, VA 22209
T: (703) 248-3322
F: (703) 807-0278
E: lyerkes@istiinc.com

Dr. Margaret Zeigler
Deputy Director
Congressional Hunger Center
229½ Pennsylvania Avenue SE
Washington, DC 20003
T: (202) 547-7022
F: (202) 547-7575
E: Mmzchc@aol.com

Dr. Stanley Zlotkin
Professor
Division of GI/Nutrition
The Hospital for Sick Children
555 University Avenue
Toronto, Ontario
CANADA, M5G 1X8
T: (416) 813-6171
F: (416) 813-4972
E: zlotkin@sickkids.on.ca

Appendix C. Biographies of Featured Speakers

Teresa Banda, a native Malawian, holds a B.Sc. in agriculture from the University of Malawi and an M.Sc. in nutrition from Howard University in Washington, DC. Her current position is National Micronutrient Coordinator for the Ministry of Health and Population in Malawi, seconded to the World Vision MICAH (MICronutrient And Health) program. In this role she coordinates and provides technical support to MICAH and other programs/organizations targeting micronutrient malnutrition in Malawi. Ms. Banda also facilitates adherence to micronutrient-related policies throughout the country and advocates for policy change. She represents Malawi in regional micronutrient task forces and workshops and has participated in a number of research studies. For five years prior to her current position she was the Senior Nutritionist/Head of Nutrition Unit at the Ministry of Health and Population.

George Beaton has a BA in food chemistry and an MA and Ph.D. in nutrition from the University of Toronto. He is currently Professor Emeritus in Nutritional Sciences and Community Health at the University of Toronto and a freelance consultant. He has received many honors and served on numerous Canadian, international, United Nations, and U.S. committees on health and nutrition. Professor Beaton is also the author/editor of three books and has published 125 research papers, reviews, and chapters.

Rita Bhatia is a public health nutritionist, now the Senior Nutritionist at UNHCR Headquarters in Geneva. She served formerly as Nutrition Coordinator of the UNHCR operation in Ethiopia and Sudan, and with the United Nations Border Relief operation and NGOs in Thailand for Cambodian, Laotian, and H'mong refugees. She also worked with NGOs in India in maternal and child health. Her expertise is in public health nutrition, food security, program design, monitoring and evaluation, program management, and training and capacity building. Ms. Bhatia initiated and developed the Interagency Food and Nutrition Group with major NGOs in food and nutrition.

Shirley Buzzard has a Ph.D. in anthropology and a M.Sc. in community development. Her dissertation research was in western Kenya. For over fifteen years, she has owned and managed a consulting firm specializing in project planning, management, and evaluation. She has provided professional consulting services in over forty-five countries worldwide, mostly to PVOs. Her technical expertise is in health, family planning, water and sanitation, and small business development. Dr. Buzzard founded the Corporate Community Investment Service (CORCOM) in 1996 with private funding, although it is now funded by a grant from USAID/BHR/PVC.

Arabella Duffield is the coordinator of the Refugee and Internally Displaced Populations Nutrition Information System at the UN Subcommittee on Nutrition in Geneva. She obtained her Ph.D. at the London School of Hygiene and Tropical Medicine in 1998, having researched the relationship between chronic energy deficiency and mortality and morbidity in adults in rural Sarawak.

John Dunn, M.D., is Professor of Medicine in the Divisions of Endocrinology and Geographical Medicine at the University of Virginia School of Medicine, Charlottesville, Virginia. He is also Secretary of the International Council for the Control of Iodine Deficiency Disorders and Editor of the *IDD Newsletter*. Dr. Dunn has made significant contributions to the elimination of iodine deficiency disorders worldwide.

Henri Dirren is head of the Clinical Evaluation Group at Nestlé Research Center in Lausanne, Switzerland. He studied experimental physics and received a doctoral degree in nuclear physics from the Swiss Federal Institute of Technology in Zurich before moving to research in nutrition and public health. For the past two decades, his research has concentrated on maternal and child nutrition in Africa and Latin America, including nutritional status assessment, food supplementation and fortification, and oral rehydration. In Europe he has studied nutrition and health in the elderly and is a member of the Steering Committee of the Euronut-SENECA project. He currently manages Nestlé's strategic clinical trials in infant, clinical, and performance nutrition.

Betsy Faga is President of the North American Millers' Association (NAMA), a non-profit organization representing dry millers of wheat, corn and rye. NAMA was established in April 1998 as a result of the merger of Protein Grain Products International (PGPI), the American Corn Millers' Federation, and the Millers' National Federation. Prior to the merger, Mrs. Faga held a variety of positions with PGPI beginning in 1969 and ACMF beginning in 1980. In the food aid arena, she has been actively engaged with PVOs and government agencies in all areas of product delivery, including nutritional composition of the products, packaging, and educational information. She has traveled extensively overseas, observing and studying product use in field programs.

Michael Golden, from Ireland, trained as a gastroenterologist in Belfast and then worked for a year with Professor John Waterlow at the London School of Tropical Medicine and Hygiene. He worked at the Tropical Metabolism Research Unit in Jamaica from 1974 to 1991, exploring the etiology and pathogenesis of kwashiorkor, marasmus, and later, stunting. He directed the Wellcome Trace Element Research Group and subsequently, TMRU itself. When Professor Golden returned to the UK in 1991, he became active in refugee nutrition, working mainly with Action Contre la Faim in Paris. He wrote the WHO manual on treatment of severe malnutrition, as well as about 300 other papers on various aspects of nutrition. He is Chairman of the Scientific Committee of ACF and an official advisor to UNICEF on matters related to severe malnutrition.

Neal Hammond is Director of New Product Development for Pacific Grain Products. He has held similar positions with Helix International and University Research and Marketing. In 1992 he formed his own food ingredient company based on technology he has since patented. Mr. Hammond served as a consultant in Honduras, formulating and producing baby foods, cereals, baked goods, and other consumer foods; as a nutritionist with Pan American Health Service; as managing chemist with the Peavey Company; and as a research technologist for the California Milling Corporation. He has also held government public health and nutrition positions in Arizona and Belize.

Steve Hansch coordinates humanitarian programs at the Congressional Hunger Center. His training is in epidemiology and human nutrition. He has also worked with the Refugee Policy Group, Food Aid Management, CARE, the International Rescue Committee, and the state public health office of Massachusetts. In the field, he supervised Ethiopian refugee feeding programs in the Sudan, and observed diets and food strategies among Central American refugees in Honduras and Mexico. He has done food cost studies with FAO and Food Aid Management, and spent time in approximately ninety refugee and IDP camps in thirty countries.

Quentin Johnson has twenty-six years of experience in the food and medical device industries in North American and the UK. For the past eight years, he has consulted to the food industry, specializing in new product development; technical services, and quality assurance; and to international development agencies, specializing in fortifying food with micronutrients. Prior to starting his own business, he was Director of Technology for Maple Leaf Mills, one of the largest milling companies in Canada.

Richard Konstance is a chemical engineer with the Eastern Regional Research Center, Agricultural Research Service of the U.S. Department of Agriculture. Mr. Konstance has been with the agency for thirty-four years, during which time he has been involved with food processing research on fruits, vegetables, and meat. He is currently a member of the Dairy Products Research Unit, where he is involved with various aspects of dairy processing research in addition to grain extrusion studies.

Andy Kovall initiated and currently directs MedPharm, a generic pharmaceutical company that produces low-cost micronutrients and multivitamins. Earlier, Mr. Kovall worked with Catholic Relief Services for a number of years overseas.

Louis Laleye holds a PhD. from Laval University in Quebec and is Director of Technology and Research at The Micronutrient Initiative in Ottawa, Canada. Before joining The MI, Dr. Laleye had over fourteen years of experience managing and developing dairy products and starter culture programs; planning and coordinating product development from scale-up implementation to production; and planning, organizing, and directing the development of new membrane milk filtration technology. He has also developed, evaluated, and implemented new rapid automated microbiology methods in quality control. Dr. Laleye helped establish Standard Operating Procedures/formulations for cheese manufacturing technology. In addition to his industry experience, he collaborates with external research centers for the elaboration of basic research in functional dairy ingredients and new manufacturing technologies. His work with The MI involves, among other things, coordination and implementation of projects abroad.

Tom Marchione has a Ph.D. in nutritional anthropology, and currently serves as Nutrition Advisor and Evaluation Officer in the Bureau for Humanitarian Response in USAID. Formerly he directed an economic advocacy project in the U.S. and served as staff sociologist at the Caribbean Food and Nutrition Institute. He has held faculty positions in the medical anthropology program at Case Western Reserve University, the Institute for Nutrition Research at the University of Oslo, Norway, and the World Hunger Program at Brown University.

John B. Mason works on improving nutrition, particularly of children and women in developing countries, as professor in the Department of International Health and Development at Tulane University. Starting his career in nutritional biochemistry with a Ph.D. from the University of Cambridge (UK), he moved on to research child health and nutrition in East and West Africa before joining the Food and Agricultural Organization (FAO) of the UN, where he worked on nutritional surveillance and program planning. He then became Director of the Cornell Nutritional Surveillance Program, conducting research and training both at Cornell and overseas. At the same time he co-directed a joint program with UNICEF to promote nutrition in East and Southern Africa. Returning to the UN in 1986, he became Technical Secretary of the UN coordinating committee on nutrition (ACC/SCN) based at WHO, started the series of UN Reports on the World Nutrition Situation and the Refugee Nutrition Information System, and supervised fifteen UN publications on nutrition policy issues. Having joined Tulane in 1996, Dr. Mason

currently focuses on nutrition policy development; approaches to sustaining community-based programs for nutrition improvement; and micronutrient deficiencies (vitamin A and iodine), in terms of epidemiology, prevention, and relation to early growth and development. He is the focal point for an inter-university consortium developing the concepts and practice of public nutrition, and teaches or co-teaches four courses on this topic.

Judith Mutamba, who has a BS in nutrition from the University of Missouri and a Masters in Medical Sciences from the University of Uppsala, Sweden, is currently Deputy Director of the Nutrition Unit in the Ministry of Health and Child Welfare in Zimbabwe. Responsible for all micronutrient control activities, she initiated fortification of maize meal in Zimbabwe through dialogue with industry. She also initiated the fortification of maize meal for the Child Supplementary Feeding Program and fortification of a blended meal used in the School Feeding Program. Mrs. Mutamba is a board member and sub-regional coordinator for the International Council on the Control of Iodine Deficiency Disorders.

Ian Newton was born and educated in New Zealand. He received a BS from the University of New Zealand in botany and zoology, specializing in pesticide development. Some years after immigrating to Canada, he joined Hoffmann-La Roche, holding positions in the Agricultural, Chemical Marketing, and Human Nutrition Divisions. He is now with Roche Vitamins in New Jersey, responsible for Regulatory Affairs and Business Development. Mr. Newton directs an extensive public information program on vitamins and polyunsaturated fatty acids for health professionals, academics, and the media. He has published articles on this subject in a variety of scientific journals.

Peter Ranum, who has an MS in Nutrition from the University of Nebraska, is a consultant in fortification and enrichment of cereal grain products. He has worked with SUSTAIN on various USAID projects related to cereal fortification, and on fortification projects in the Middle East, Russia, Africa, Central America, Indonesia, and India. He was formerly Technical Director of the Flour Service Department of Elf Atochem in Buffalo, New York. He has published some forty articles on oxidation and enzymes in baking and on enrichment of cereal products. Mr. Ranum is an active member of the American Association of Cereal Chemists, the Institute of Food Technologists, and the American Baking Society.

Dan Shaughnessy, Workshop Moderator, is vice president of the Council for Responsible Nutrition, an association of the dietary supplement industry. Previously he was executive director of Project Concern International, which develops public health services worldwide. He spent over eighteen years with the federal government, both in Washington and abroad, in USAID's Food for Peace Program and in the Office of the Secretary of State, where he aided U.S. involvement in the first UN World Food Conference. As executive director of the Presidential Commission on World Hunger, Mr. Shaughnessy reported to the President and to Congress.

Nina P. Schlossman is president of Global Food & Nutrition Inc (GF&N), a small, woman-owned consulting firm based in Maryland that works with academia, governments, nongovernmental organizations (NGOs), private voluntary organizations (PVOs), and private sector clients. Through her position with GF&N, Dr. Schlossman conducts technical assistance, policy, and market analysis, training, and research in a variety of food and nutrition areas, including food security, women's and children's nutrition, infant feeding, food fortification, and micronutrients. GF&N works with the National Dry Bean Council (NDBC) to increase the use of US dry beans in US food assistance programs. Dr. Schlossman serves as the NDBC's liaison with the PVO community, works on the interaction between commercial and food aid sales, magnetization, and related issues, and provides overall nutrition information for general

marketing purposes. She has extensive experience in Africa, Asia, and Latin and Central America.

Florence Tartanac is a Food Industry Engineer with a degree from ENSIA-Massay, France, and a Ph.D. in economic geography from Paris X-Nanterre University. She directs the Food Technology Unit at the Institute of Nutrition of Central America and Panama (INCAP), with headquarters in Guatemala.

Allison Tweeddale has a B.Sc. in dietetics from the University of British Columbia and works as a Nutrition Officer in the International Programs Group at World Vision/Canada. Her responsibilities cover the nutrition component of relief and rehabilitation programs as well as overseeing the MICAH (MICronutrient And Health) program in Malawi. MICAH/Malawi works with thirteen partners, including NGOs and the Ministries of Health and Agriculture, to address micronutrient malnutrition through integrated strategies. One of the program's new initiatives is the development of community-based maize flour fortification as a sustainable strategy to improve the micronutrient status of the rural population.

Fritz van der Haar is an associate professor at the Emory University School of Public Health, Atlanta, where he teaches and does research on the global elimination of micronutrient malnutrition. He is also Technical Director of the Program against Micronutrient Malnutrition (PAMM), and a visiting professor at the Wageningen Agricultural University Department of Human Nutrition in the Netherlands, where he was formerly a senior scientist and head of the Food Technology and Nutrition Sector. Dr. van der Haar spent four years as a senior lecturer in Child Health and Nutrition in the Department of Pediatrics and Child Health, University of Dar es Salaam, Tanzania, during which time he assisted the Ministry of Health in designing and developing national programs for the elimination of iodine and vitamin A deficiencies.

Noel Vietmeyer is a former scientist with the National Academy of Sciences. He has contributed to the book *Lost Grains of Africa*, as well as other works. Presently he is a freelance consultant and actively involved with the Power Flour Action Network, promoting amylase-fortified cereals for use in developing countries.

Willem Wurdemann is a member of the Department of Agriculture and Enterprise Development at the Royal Tropical Institute in Amsterdam. With a M.Sc. from the Agricultural University of Wageningen, Netherlands, he is a food technologist and business economist with extensive experience in the development of small and medium enterprise food and agro-processing. He has specific experience in local production of weaning foods based on cereals and oilseeds in various African countries. In addition to the Lukuni Phala project in Malawi, he has been involved with rural industries that process rice, cassava, coconut oil, and fish in Asia, Asia, and Latin America.

Stanley Zlotkin received his medical training at McMaster and McGill Universities in Canada, and obtained a Ph.D. in nutrition at the University of Toronto. He has worked as a clinician-nutritionist and research scientist at The Hospital for Sick Children in Toronto since 1980. He is currently a professor in the Departments of Pediatrics and Nutritional Sciences at the University of Toronto, a senior scientist at the Research Institute of The Hospital for Sick Children, Medical Director of Nutrition Support, and chief of the Division of Gastroenterology and Nutrition at the Hospital for Sick Children. His research interests involve examining mineral requirements and metabolism in infants; clinical trials to treat and prevent iron and vitamin A deficiency; and establishing evidence-based nutrition public policy.

Appendix D. UNICEF Conceptual Framework for Basic Causes of Malnutrition

The UNICEF conceptual framework on the causes of malnutrition was developed in 1990 as part of UNICEF's nutrition strategy. The framework below shows that causes of malnutrition are multisectoral, taking into account food, health and caring practices. Causes are also categorized as immediate, underlying, and basic, whereby factors at one level influence other levels. The framework serves as a guide for those making health policy decisions in assessing and analyzing the causes of the nutrition problem. These causes are also factors in emergency situations and should be taken into account in health planning and response for relief settings. (see figure next page)

Appendix E. Prevalence of Micronutrient Deficiencies Worldwide

Table 1. Estimated Number of Preschool Children (in Millions) Affected by the Three Main Forms of Micronutrient Malnutrition

Region	Anemia	Subclinical VAD	Clinical VAD	IDD
South Asia	93.8	59.5	1.58	42.5
Sub-Saharan Africa	34.1	36.0	0.98	30.1
Middle East / North Africa	17.7	4.2	0.12	11.1
East Asia / Pacific	20.0	20.0	0.4	31.1
Latin America / Caribbean	13.0	10.2	0.12	8.8
Total	**178.6**	**129.9**	**3.2**	**123.6**

Source: Mason, J.B.; K. Sethuraman, A.. Gilman, K. Mason, K. Gillenwater, N. Mock, and M. Lotfi, *Progress in Controlling Micronutrient Deficiencies*.Ottawa: The Micronutrient Initiative (in progress).

****

Table 2. Estimated Numbers of People (in Millions) At Risk of the Three Main Forms of Micronutrient Malnutrition

Region	Iron Deficiency or Anemia	Vitamin A Deficiency (Preschool Children Only)	Iodine Deficiency Disorders (IDD)
Africa	206	52	181
Americas	94	16	168
Southeast Asia	616	125	486
Europe	27	-	141
Eastern Mediterranean	149	16	173
Western Pacific	1058	42	423
Total	**2150**	**251**	**1572**

Source: FAO, ILSI, *Preventing Micronutrient Malnutrition: A Guide to Food-based Approaches. A manual for policy makers and program planners*. Washington: ILSI (1997).

Appendix F. Annotated Bibliography

prepared by Jessica Graef, Food Aid Management
September 1999

This bibliography represents a sample of the resources on micronutrient interventions, fortification, supplementation, and nutrition in emergencies that are available at Food Aid Management's (FAM) Food Security Resource Center (FSRC). This bibliography is divided into the following separate subtopic areas:

- fortification of cereal commodities
- fortification of non-grain commodities
- food fortification in relief/refugee settings
- specialty foods
- operational issues/programming
- nutrition in emergencies
- agricultural approaches to address micronutrient malnutrition
- supplementation.

As many of the resources address several of these issues, some documents are listed under multiple sections. Workshop participants and other interested parties are encouraged to contact or visit the FSRC to make use of these resources.

FORTIFICATION OF CEREAL COMMODITIES

Enhancing the nutritional quality of relief diets: Overview of knowledge and experience. *April 1999. Hansch, Steve. 48p.*
Prepared for Enhancing the Nutritional Quality of Relief Diets workshop (April 28-30, 1999, Washington, DC), provides background information on: malnutrition in emergencies; humanitarian relief standards for nutrition; approaches to addressing malnutrition in emergencies; use of fresh foods and supplementation; donor country measures to process foods; in-theater fortification and enrichment methods; comparison of food vehicles used; inputs necessary for in-country fortification; IEC, agriculture, and other interventions; and problems associated with vitamin C. Discusses fortification of the following commodities: grain, flour, CSB, WSB, biscuits, oil, and sugar.

Field exchange. Special focus: Micronutrients. *October 1998, Field Exchange, Issue 5. Emergency Nutrition Network. 27p. FSRC #5769.*
Focuses on micronutrients. Includes in addition to a wide range of articles on emergency feeding programs sections on micronutrient deficiency diseases among Bhutanese refugees in Nepal and various strategies to address micronutrient deficiencies during emergency situations. Discusses vitamin C fortification of CSB as well as a WFP program examining in-country capacity for food fortification.

Small scale mills fortification concept paper in Malawi for pilot project. *12p. FSRC #7623.*

Outlines justification and strategies for small-scale maize flour fortification milling in Malawi. Discusses micronutrient deficiencies in Malawi. Outlines methodology of the pilot project, describes premix composition, and presents budget information.

Production of pre-cooked fortified blended foods in Kenya: A success story. *1997. Göte, Hertz. August 1997 Field Exchange. 2p. FSRC #5769.*
Discusses Kenya program that developed local production capacity for fortified pre-cooked blended food. The operation has handled millet, wheat, maize, and soya flour and has produced UNIMIX and high protein biscuits. Discusses output, uses, and packaging of the blended food and challenges faced by the factory.

Fortification of foods for refugee feeding. Final report to the Canadian International Development Agency. *1995. 113p. Beaton, G.H. FSRC #5552.*
Considers role and specifications of fortified foods, existing and potential. Studies nutritional inadequacies of refugee diets and presents strategies to address these deficiencies. Discusses supplementation, fortification of the staple cereal, and promotion of gardens. Considers effectiveness and cost issues, and argues strongly for fortification of staple cereal rather than reliance on blended foods to supply micronutrients for refugee populations.

Fortification of foods for refugee feeding. Technical background report: Derivations and analyses. Report to the Canadian International Development Agency. *1995. Beaton, G.H. 79p. FSRC #5553.*
Provides "supporting technical details" for Fortification of Foods for Refugee Feeding report (see FSRC #5552). Explains derivation of reference nutrient density profiles. Compares fortification and blended foods. Tests use of supplements in non-refugee population. Discusses food composition data used in calculations.

Forum on iron fortification: Forum proceedings. Institute of Food Technologists annual meeting, June 21, 1997, Atlanta, Georgia. *1999. SUSTAIN. 55p.*
Presents "current state of understanding of iron fortification" and outlines developments in the area of iron fortification. Includes overview of iron deficiency, fortification methods, bioavailability, absorption, and Iron EDTA. Among other items, discusses fortification of wheat flour food and infant cereals. Available at http://www.sustaintech.org/publications_frameset.html.

Fortification of corn masa flour with iron and/or other nutrients: A literature and industry experience review. *1997. SUSTAIN; Bressani, Ricardo; Rooney, Lloyd; Serna Saldivar, Sergio O. [170]p.*
Examines fortification of nixtamilized corn flour (NCF) with iron. Discusses nutritional quality of NCF, lime-treated corn flour, micronutrient fortification of NCF, fortification of flours and other cereal-based products, and fortification and enrichment of corn tortillas.

Workshop on quality control and assurance in milling and fortification of corn masa flour, San Salvador, El Salvador, March 16-17, 1998. *1998. SUSTAIN; McFarlin, Keith; Lopez, Ximena. [70]p.*
Outlines workshop on quality control and assurance in milling and fortification. Focuses on nutrition and fortification issues relevant to industry and public sector participants.

Iron fortification of flour in the Middle East region. *1998. SUSTAIN; Varchaver, Catherine. [60]p.*
Provides information on 1998 flour fortification. Presents background on iron deficiency and iron fortification issues, covering fortification versus supplementation and nutrition education. Outlines programming opportunities.

Peru trip report, September 19-26, 1998. SUSTAIN Micronutrient Assessment Program. *1998. Schlossman, Nina P.; Ranum, Peter; Soria, Andreina. [60]p.*
Reports on study of vitamin A content of samples of P.L. 480 Title II bulgur and wheat flour. Includes suggestions on how to revise the Commodities Reference Guide and provides information for effort to fortify P.L. 480 vegetable oil.

International workshop on micronutrient enhancement of rice, September 2 & 3, 1998, Stuttgart, Arkansas. *1998. University of Arkansas; Micronutrient Initiative; SUSTAIN; ILSI; OMNI. [80]p.*
Summarizes workshop with the following objectives: discuss current rice fortification and enhancement technologies; promote better understanding of rice fortification and micronutrient enhancement technologies; and recommend follow-up activities to address micronutrient deficiencies through rice fortification and biotechnology. Panel sessions focus on plant breeding and biotechnology, status of rice fortification technology and program implementation, processing and marketing of rice, and policy and regulatory considerations for rice fortification.

PANamericano 1997 meeting: Growing the flour-based foods market in Latin America, Mexico, March 16-17, 1997. *1997. SUSTAIN; Ranum, Peter. [35]p.*
Reports on conference for executives from Latin American flour, milling, baking, and other food industries to discuss "how their companies can benefit from and further stimulate increasing consumer demand for these foods." Includes discussion of USAID and SUSTAIN activities in fortification of milled cereal products with iron.

Russia flour enrichment assessment, June 29-July 10, 1998, Trip report. *1998. SUSTAIN; Gies, Bob. [40]p.*
Reports on feasibility assessment tour for fortification in flourmills and bakeries in various regions of Russia, feasibility of flour enrichment, and outcomes of meetings with industry representatives in Russia.

Workshop: The problem of micronutrient malnutrition in the Russian Federation, Moscow, Russia, June 25-July 2, 1997. *1997. SUSTAIN; Ranum, Peter; Turner, Liz; Yeung, David. [45]p.*
Presents summary of workshop on "Russian action plans to address micronutrient deficiencies relating to maternal and child health." Covers scientific, technical, regulatory, and policy issues. Presentations include discussion of iron fortification of bread flour.

MICAH matters. *1999. V.4, no. 1. Micronutrient and Health (MICAH). World Vision Canada. 4p. FSRC #7615.*
Includes brief articles on training workshops, small-scale fortification of flour and maize blending systems, vegetable gardening, literacy programs, water and sanitation, and country updates.

Micronutrient fortification and enrichment of P.L. 480 Title II commodities: Recommendations for improvement. *Opportunities for Micronutrient Interventions (OMNI). 1994. 70p. FSRC #7228.*

Examines various options for micronutrient fortification of USAID food aid commodities (mainly CSB and WSB). Includes technical information about past and current enrichment and fortification practices, quality assurance of fortified commodities, product and fortificant stability, and appropriate and safe levels of fortification. Presents recommendations to improve micronutrient content of P..L. 480 Title II commodities.

Micronutrient deficiencies in Latin America and the Caribbean: Vitamins. *Mora, Jose O.; Mora, Olga L. PAHO/WHO; USAID; Roche; OMNI. 41p.*
Provides overview of micronutrient deficiencies in Latin America and the Caribbean, specifically focusing on vitamins. Discusses supplementation and food fortification (sugar, wheat and corn flour, milk, rice, vegetable oil, margarine, and infant cereals). Includes both English and Spanish language text.

Food fortification in developing countries. *Nestel, Penelope; USAID. 45p.*
Reviews literature on food fortification with vitamin A, iron, and iodine. Examines determination of fortification levels, issues involved in fortification activities, quality control, monitoring and evaluation of fortification programs, economic issues, and political and legal considerations. Discusses fortification of sugar, wheat flour, corn flour, rice, maize meal, salt, milk, biscuits, and condiments.

Requirements for effective fortification in food aid programmes. *1995. Dexter, Patricia. FAO Technical Consultation, Food Fortification: Technology and Quality Control, Rome, Italy, 20-23 November 1995. 19p. FSRC #7635.*
Examines "requirements for effective fortification for food aid programs." Considers existing fortification of food aid activities (blended foods, processed cereal, vegetable oil, high protein biscuits, dried skim milk powder, salt, whole grains). Discusses cost and nutritional impact issues, quality assurance, criteria for fortification of food aid, limiting factors, and need for international guidelines.

Food fortification: Technology and quality control. *FAO Technical Consultation. Istituto Nazionale della Nutrizione, Rome, Italy, 20 to 23 November, 1995. 34p. FSRC #7598.*
Reports on consultation concerning food fortification. Includes summary of conclusions and recommendations as well as background information on food fortification. Contains sections on iodine, iron, and vitamin fortification technologies; legislation information; monitoring procedures; and fortification in food aid programs. Discusses fortification of salt, oils, and cereals. Available at www.fao.org/WAICENT/FAOINFO/ECONOMIC/ESN/fortify/fortify.htm.

Food fortification to end micronutrient malnutrition: State of the art, Satellite conference of the XVIth International Congress of Nutrition, Symposium report, August 2, 1997, Montreal, Canada. *1998. Micronutrient Initiative. 113p. FSRC #7402.*
Reports from symposium on fortification. Includes sections on fortification of oils, fats, margarine, dairy products, milled grains and cereal products (wheat flour, corn flour, noodles, and rice), and condiments.

Vitamin C fortification of food aid commodities. *1997. Institute of Medicine; Committee on International Nutrition; Food and Nutrition Board. 87p. FSRC #7165.*
Discusses cost-effectiveness of scaling up vitamin C fortification in Title II commodities, mainly CSB and WSB, to improve recipients' diet, nutrition and health. Makes recommendations concerning its advisability, discusses alternative mechanisms for providing vitamin C to refugee populations at risk for deficiencies, and identifies areas in which additional research is needed.

SUSTAIN results report on the vitamin C pilot program. *1997. SUSTAIN; Ranum, Peter; Chomé, Françoise. 154p. FSRC #6883.*
Contains results of USAID Vitamin C Pilot Program for use by USAID in consultation with National Academy of Sciences to determine appropriate vitamin C fortification levels in food commodities used in U.S. food aid programs. Focuses on two commodities provided in Tanzania and Haiti, CSB and WSB, that were fortified with higher levels of vitamin C.

Report of a technical review of vitamin C and iron levels in P.L. 480 Title II commodities. *1990. USAID. 20p. FSRC #401.*
Reports from panel formed to investigate increased fortification of Title II commodities. Recommended actions include increased iron fortification, maintenance of current level of vitamin C, and investigation of alternate delivery systems due to stability problems.

Iron EDTA for food fortification. *1998. International Nutritional Anemia Consultative Group. 54p. FSRC #7631.*
Reports on use of sodium iron ethylenediaminetetraacetic acid (NaFeEDTA) in food fortification. Covers physical properties and physiological effects of ethylenediaminetetraacetic acid (EDTA), studies of effects of NaFeEDTA on human iron absorption, and results of field trials of NaFeEDTA (using sugar and condiments). Discusses steps in developing an iron fortification strategy, choosing a vehicle for iron fortification, and use of NaFeEDTA in wheat flour and other cereals.

Interagency meeting: Iron fortification in the Americas. *March 1998. Pan American Health Organization (PAHO). 9p. FSRC #7597.*
Reports on March 1998 workshop on iron fortification programs. Provides background information on iron deficiency and its prevention and control. Includes discussion of quality assurance and epidemiological surveillance. Examines premix and compound strategies. Includes consensus points, research priorities, and discussion items. Available at www.paho.org/english/hpp/hpn9803.htm.

Early response to the effect of iron fortification in the Venezuelan population. *December 1996. Layrisse, Miguel; Cháves, José Félix; Mendez-Castellano, Hernán; Bosch, Virgilio; Tropper, Eleonora; Bastardo, Betsi; González, Eglis. The American Journal of Clinical Nutrition (vol. 64, no. 6). 903-7. FSRC #7399.*
Reports results of preliminary survey of sample of children aged 7, 11, and 15 in Caracas in 1994. Shows that prevalence of iron deficiency and prevalence of anemia were reduced as a result of an iron fortification program under which precooked yellow and white maize and wheat flours were enriched.

Iron interventions for child survival. *1995. Nestel, Penelope (ed.). USAID; OMNI; ICH. 170p.*
Summarizes proceedings of London workshop organized by USAID/OMNI and Institute for Child Health on reducing and controlling iron deficiency anemia in infants and young children. Discusses fortification of foods (cereal flours, beverages, and milk) and supplementation.

Use of food aid in locally processed infant foods: Sustainable approach to reduce hunger. *1994. Huffman, Sandra; Nurture/Center to Prevent Childhood Malnutrition. 8p. FSRC #1039.*
Urges availability of processed fortified instant cereals through U.S. food aid program.

Musaga child nutrition, final report. *1987. Catholic Relief Services/Burundi. 42p. FSRC #7620.*
Reports on use of Musalac weaning food among children in Musaga, Burundi. Discusses local acceptance of Musalac, nutritional values, pricing information, packaging, storage and milling information, and project goals. Includes progress report.

Acceptability and use of cereal-based foods in refugee camps: Case-studies from Nepal, Ethiopia, and Tanzania. *1998. Mears, Catherine and Young, Helen. Oxfam Working Paper. 135p. FSRC #7139.*
Reports on nutritional study commissioned by Micronutrient Initiative on use and acceptability of cereal-based foods in refugee camps, as well as opportunities for fortification of cereals with micronutrients at household level. Case studies conducted in refugee camps in areas with histories of acute malnutrition and micronutrient deficiencies in Nepal, Ethiopia, and Tanzania,.

Approaches to the micronutrient fortification of food for displaced populations in Africa: Project report. *1998. Micronutrient Initiative. 27p. FSRC #7415.*
Reports on Refugee Policy Group mission to East Africa under contract by Micronutrient Initiative, to "examine how food aid for refugees and other emergency-affected populations could be fortified using in-country processes." Examines fortification of cereals, primarily wheat and maize. Outlines findings and recommendations. Discusses local commercial millers and food processing capacity; stability of food aid; and role of NGOs, Red Cross, WFP, UNICEF, and UNHCR.

Fortification of foods for refugee feeding: An idea whose time has come? *July 1997. Micronutrient Initiative. 6p. FSRC #7611.*
Focuses on fortification of food for refugee feeding activities. Summarizes 1995 George Beaton report on topic. Discusses ways to fortify refugee foods, strategic approach, fortification of cereals, research and information needs, and Micronutrient Initiative activities in this area.

Provision of blended foods and high energy biscuits in the Great Lakes Region. Mission report (1st draft), 23 January - 26 February, 1998. *Merx, Richard J.H.M. World Food Programme. 48p. FSRC #7617.*
Reports on consultancy to "identify options for cost effective production for WFP of high-energy biscuits and blended food school meals in the Great Lakes Region." Includes pre-assessment of regional "WFP lunch box concept." Presents situation analysis. Discusses formulas, nutritive values, and production process for blended foods and high energy biscuits. Considers capacity requirements for UNIMIX and HEB production. Examines project feasibility and sustainability.

Fortification basics: Wheat flour. *OMNI; Roche; USAID. FSRC #6882.*
Describes nutritional qualities of wheat flour. Notes wheat fortification process, i.e., vitamins added, techniques used to add nutrients, costs, and impact on public health.

Fortification basics: Principles of assay procedures. *OMNI/Roche/USAID. 4p.*
Briefly describes different laboratory methods to analyze various micronutrients added to foods (vitamins A, B-complex, C, D, E, iron, and iodine).

Fortification basics: Maize flour/meal. *MOST/Roche/USAID. 4p.*
Presents information on fortification of maize flour/meal. Includes sections on fortification criteria, technology, stability of micronutrients, quality control, costs, legislation, and examples of interventions.

Fortification of wheat flour with vitamin A: Update. 1998. *USAID; UNICEF; OMNI Project/John Snow Inc. 16p. FSRC #7221.*
Discusses technology and issues related to stability of vitamin A, sensory characteristics, quality assurance and control, and cost of wheat flour fortified with vitamin A and other micronutrients.

Sri Lanka trip report: Fortification of wheat flour with vitamins and minerals. *1990. Crowley, Paul R.; USDA. [50]p. FSRC #2126.*
Reports on trip to examine feasibility of fortification of Sri Lanka-milled wheat flour with vitamins and minerals. Discusses impact of fortification on wheat market in Sri Lanka.

Rice fortification for developing countries. *1998.*
Provides overview of importance of rice as a staple food and food vehicle for fortification in countries where populations suffer from micronutrient deficiencies. Discusses available technology, current fortification practices, and limitations and opportunities for rice fortification.

Global directory of commercial manufacturers of micronutrient premixes and supplements. First edition. *December 1997. Micronutrient Initiative. FSRC #7467.*
Lists manufacturers worldwide that formulate and produce micronutrient premixes and supplements "that meet recognized international standards for production manufacture, quality assurance and use." Includes background information on micronutrients and names of manufacturers of such fortified foods as salt, sugar, cereals and other flour products, and milk. Available on the Micronutrient Initiative website at http://www.idrc.ca/mi/index.html.

On order:

Micronutrient Assessment Project final report. *Forthcoming, September 1999. SUSTAIN.*
Reports on Micronutrient Assessment Project (MAP) three-year study to "determine the level of micronutrients in the fortified food commodities provided in the United States (U.S.) P.L.480 food assistance program which reaches the mothers, children, and refugees targeted by emergency and development feeding programs in developing countries." Lists recommendations for improvements of U.S. food aid program as related to micronutrients.

Thiamine deficiency and its prevention and control in major emergencies. *WHO.*
Provides guidelines on assessment and prevention. Discusses several means of increasing intake of thiamin in an emergency situation, including fortification of wheat flour, corn meal, and salt.

Workshop on small scale milling. *1999. The Micronutrient Initiative. Draft.*
Outlines proceedings from June 1998 Ottawa workshop on small-scale fortification. Small workshop (approximately 12 people) attended by representatives of NGOs planning and/or implementing fortification programs in small-scale settings such as refugee camps, or at community/household level, as well as representatives from donor agencies, nutrition specialists, and fortification and food technologists. Highlights issues discussed and available technology for small-scale fortification.

Technical manual on flour fortification. *1999. MI/OMNI/USAID. In preparation.*
Under development, plans to outline in three-volumes milling practices, fortification procedures, selection of fortificants, equipment requirements, quality control procedures, and program development.

FORTIFICATION OF NON-GRAIN COMMODITIES

Fortification basics: Sugar. *OMNI/Roche/USAID. 4p.*
Provides information on rationale, fortification criteria, required technology, quality control, and cost associated with sugar fortification. Includes premix composition data.

Manual for sugar fortification with vitamin A:

Guidelines for the development, implementation, monitoring and evaluation of vitamin A sugar fortification program. *1996. Arroyave, Guillermo; Dary, Omar. 57p. FSRC #7222.*

Manual for sugar fortification with vitamin A: Technical and operational guidelines for preparing vitamin A premix and fortified sugar. *1996. Dary, Omar; Arroyave, Guillermo. 41p. FSRC #7223.*

Manual for sugar fortification with vitamin A: Analytical methods for the control and evaluation of sugar fortification of vitamin A. *1996. Dary, Omar; Arroyave, Guillermo; Flores, Hernando; Campos, Florisbela A.C.S.; Lins, Maria Helena C.B. 81p. FSRC #7224.*

Based on experiences in sugar fortification at Institute of Nutrition of Central America and Panama (INCAP), Part I describes why it is important to prevent and reduce vitamin A deficiency and how to establish such a program, and discusses existing strategies and basic elements. Part II covers general aspects of fortification process; manufacture of premix and procedures for adding premix to sugar; and detailed description of quality control. Part III (for laboratory personnel responsible for laboratory analyses) presents field and laboratory methods to estimate content of vitamin A in premix and fortified sugar. Gives details on how to determine retinol levels in biological samples.

Capacity of sugar fortification to combat vitamin A deficiency: Evidence from an ISO/PAMM survey. *1997. International Sugar Organization. Market Evaluation Consumption and Statistics Committee(97)20. 13p. FSRC #7480.*
Examines fortification of sugar with vitamin A to prevent and control vitamin A deficiency. Discusses cost, review of existing programs, and regions of the world where fortification is feasible.

Forum on iron fortification: Forum proceedings. Institute of Food Technologists annual meeting, June 21, 1997, Atlanta, Georgia. *1999. SUSTAIN. 55p.*
Presents "current state of understanding of iron fortification" and outlines developments in iron fortification. Provides overview of iron deficiency, fortification methods, bioavailability, absorption, and Iron EDTA. Includes discussion of iron fortification of liquid formula and condiments. Available at http://www.sustaintech.org/publications_frameset.html.

Iron EDTA for food fortification. *1998. International Nutritional Anemia Consultative Group. 54p. FSRC #7631.*
Reports on use of sodium iron ethylenediaminetetraacetic acid (NaFeEDTA) in food fortification. Covers physical properties and physiological effects of ethylenediaminetetraacetic acid (EDTA), studies of effects of NaFeEDTA on human iron absorption, and results of field trials of NaFeEDTA (using sugar and condiments). Discusses steps in developing an iron fortification strategy, choosing a vehicle for iron fortification, and use of NaFeEDTA in wheat flour and other cereals.

Micronutrient deficiencies in Latin America and the Caribbean: Vitamins. *Mora, Jose O.; Mora, Olga L. PAHO/WHO; USAID; Roche; OMNI. 41p.*
Provides overview of micronutrient deficiencies in Latin America and the Caribbean, specifically focusing on vitamins. Discusses supplementation and food fortification (sugar, wheat and corn flour, milk, rice, vegetable oil, margarine, and infant cereals). Includes both English and Spanish language text.

Fortified foods contribute one half of recommended vitamin A intake in poor urban Guatemalan toddlers. *1998. Krause, Vivian M.; Delisle, Helene; Solomons, Noel W. Journal of Nutrition, vol. 128, no. 5. pp. 860-864. FSRC #7599.*
Reports on study of vitamin A intake from food sources among children in two poor communities in Guatemala City, showing that fortified foods (fortified sugar, Incaparina, and margarine) are important non-breast milk food sources for vitamin A intake in this sample.

Food fortification in developing countries. *Nestel, Penelope; USAID. 45p.*
Reviews literature on food fortification with vitamin A, iron, and iodine. Examines determination of fortification levels, issues involved in fortification activities, quality control, monitoring and evaluation of fortification programs, economic issues, and political and legal considerations. Discusses fortification of sugar, wheat flour, corn flour, rice, maize meal, salt, milk, biscuits, and condiments.

Micronutrient deficiencies in Latin America and the Caribbean: Iodine, calcium, and zinc. *Mora, Jose O.; Mora, Olga L. PAHO/WHO; USAID; Roche; OMNI. 33p.*
Provides overview of micronutrient deficiencies in Latin America and the Caribbean. Focuses on iodine, calcium, and zinc. Discusses salt iodization and zinc supplementation. Includes both English and Spanish language text.

Sustaining elimination of iodine deficiency disorders in South Asia. *1997. Pandav, Chandrakant S. Malnutrition in South Asia: A regional profile. UNICEF, Regional Office for South Asia. ROSA Publication No. 5. 189p. FSRC #6893.*
Examines Iodine Deficiency Disorders (IDD) in South Asia and discusses iodized salt activities.

Quality assurance workshop for salt iodization programs. *October 1996. OMNI; PAMM; USAID; UNICEF; MI. 43p. FSRC #7206.*
Summarizes workshop on improving quality assurance systems for salt iodization programs. Covers salt production, processing, and iodization; packaging and labeling; wholesale and retail level quality assurance; standards and enforcement; laboratory analyses and salt test kits; and policy and program issues.

Requirements for effective fortification in food aid programmes. *1995. Dexter, Patricia. FAO Technical Consultation, Food Fortification: Technology and Quality Control, Rome, Italy, 20-23 November 1995. 19p. FSRC #7635.*
Examines "requirements for effective fortification for food aid programs." Considers existing fortification of food aid activities (blended foods, processed cereal, vegetable oil, high protein biscuits, dried skim milk powder, salt, whole grains). Discusses cost and nutritional impact issues, quality assurance, criteria for fortification of food aid, limiting factors, and need for international guidelines.

Food fortification: Technology and quality control. *FAO Technical Consultation. Istituto Nazionale della Nutrizione, Rome, Italy, 20 to 23 November, 1995. 34p. FSRC #7598.*

Reports on consultation concerning food fortification. Includes summary of conclusions and recommendations as well as background information on food fortification. Contains sections on iodine, iron, and vitamin fortification technologies; legislation information; monitoring procedures; and fortification in food aid programs. Discusses fortification of salt, oils, and cereals. Available at www.fao.org/WAICENT/FAOINFO/ECONOMIC/ESN/fortify/fortify.htm.

Fortification basics: Oils and margarine. *OMNI/Roche/USAID. 4p.*
Describes nutritional qualities of oils and fats, fortification criteria, technology available, stability issues of micronutrients used to fortify, acceptability of fortified margarine and oil products, quality control, costs of fortification, legislation necessary, and history of successful interventions using fortified fats.

Vitamin A fortification of PL480 vegetable oil. *1998. SUSTAIN. 54p. #7348.*
Examines vitamin A fortification of P.L. 480 vegetable oil. Report "suggests that distribution of fortified P.L. 480 vegetable oil could significantly reduce the rate of childhood blindness as well as the morbidity of mortality rates stemming from common childhood infections." Provides technical analysis of fortification studies and offers recommendations. Discusses safety and technology issues.

Food fortification to end micronutrient malnutrition: State of the art, Satellite conference of the XVIth International Congress of Nutrition, Symposium report, August 2, 1997, Montreal, Canada. *1998. Micronutrient Initiative. 113p. FSRC #7402.*
Reports on symposium on fortification. Includes sections on fortification of oils, fats, margarine, dairy products, milled grains and cereal products (wheat flour, corn flour, noodles, and rice), and condiments.

Iron interventions for child survival. *1995. Nestel, Penelope (ed.). USAID; OMNI; ICH. 170p.*
Outlines proceedings of London workshop organized by USAID/OMNI and Institute for Child Health on efforts to reduce and control iron deficiency anemia in infants and young children. Discusses fortification of foods (cereal flours, beverages, and milk) and supplementation.

Influence of ascorbic acid on iron absorption from an iron-fortified, chocolate-flavored milk drink in Jamaican children. *May 1998. Davidsson, Lena; Walczyk, Thomas; Morris, Audrey; Hurrel, Richard F. The American Journal of Clinical Nutrition (vol. 67, no. 5). 873-7. FSRC #7398.*
Reports on evaluation of influence of ascorbic acid on iron absorption from an iron-fortified, chocolate-flavored milk drink in 6- and 7-year-old Jamaican children. Finds iron absorption significantly greater with addition of ascorbic acid and concludes that regular consumption of iron-fortified chocolate milk drinks containing added ascorbic acid could have positive effect on iron nutrition in population groups vulnerable to iron deficiency.

Effects of iron fortification in a school feeding scheme and anthelmintic therapy on the iron status and growth of six- to eight-year-old schoolchildren. *March 1996. Kruger, Marita; Badenhorst, Charl J.; Mansvelt, Erna P.G.; Laubscher, Jacoba A.; Benadé, A. J. Spinnler. Food and Nutrition Bulletin. Vol. 17, No. 1.*
Studies effect of iron fortification of soup (iron and vitamin C) in school feeding scheme and effect of anthelmintic therapy on haematological and iron status and growth in 6- to 8-year-old schoolchildren in South Africa.

Enhancing the nutritional quality of relief diets: Overview of knowledge and experience. *April 1999. Hansch, Steve. 48p.*
Prepared for Enhancing the Nutritional Quality of Relief Diets workshop (April 28-30, 1999, Washington, DC), provides background information on malnutrition in emergencies; humanitarian relief standards for nutrition; approaches to addressing malnutrition in emergencies; use of fresh foods and supplementation; donor country measures to process foods; in-theater fortification and enrichment methods; comparison of food vehicles used; inputs necessary for in-country fortification; IEC, agriculture, and other interventions; and problems associated with vitamin C. Discusses fortification of grain, flour, CSB, WSB, biscuits, oil, and sugar.

Global directory of commercial manufacturers of micronutrient premixes and supplements. First edition. *December 1997. Micronutrient Initiative. FSRC #7467.*
Lists manufacturers worldwide that formulate and produce micronutrient premixes and supplements "that meet recognized international standards for production manufacture, quality assurance and use." Includes background information on micronutrients and manufacturers of such fortified foods as salt, sugar, cereals and other flour products, and milk. Available on Micronutrient Initiative website at http://www.idrc.ca/mi/index.html.

On order:

Thiamine deficiency and its prevention and control in major emergencies. *WHO.*
Provides guidelines on assessment and prevention. Discusses several means of increasing intake of thiamin in emergency situations, including fortification of wheat flour, corn meal, and salt.

An investment in the future: The fortification of staple foods with vitamin A. *1998. BASF Health and Nutrition. 11p.*
Describes BASF vitamin A fortification of staple foods. Addresses problems of and solutions to vitamin A deficiency, describes BASF's products for fortification (such as microencapsulated vitamin A), and covers technical issues involved in fortifying sugar, flour and oil with vitamin A.

The costs and effectiveness of three vitamin A interventions in Guatemala. *1996. Phillips M.; Sanghvi T.; Suarez R.; McKigney J.; Fiedler, J.. Soc. Sci. Med. 42 (12):1661-1668.*

FOOD FORTIFICATION IN RELIEF/REFUGEE SETTINGS

Fortification of foods for refugee feeding. Final report to the Canadian International Development Agency. *1995. 113p. Beaton, G.H. FSRC #5552.*
Considers role and specifications of fortified foods, existing and potential. Studies nutritional inadequacies of refugee diets and presents strategies to address these deficiencies. Discusses supplementation, fortification of staple cereal, and promotion of gardens. Considers effectiveness and cost issues, and argues strongly for fortification of staple cereal rather than reliance on blended foods to supply micronutrients for refugee populations.

Fortification of foods for refugee feeding. Technical background report: Derivations and analyses. Report to the Canadian International Development Agency. *1995. Beaton, G.H. 79p. FSRC #5553.*
Provides "supporting technical details" for Fortification of Foods for Refugee Feeding report (see FSRC #5552). Explains derivation of reference nutrient density profiles. Compares fortification

and blended foods. Tests use of supplements in non-refugee population. Discusses food composition data used in calculations.

Preventing micronutrient deficiency diseases. *1994. Toole, Michael J. Background document #2, Workshop on the Improvement of the Nutrition of Refugees and Displaced People in Africa, Machakos, Kenya, 5-7 December, 1994, ACC/SCN; UNHCR.*
Outlines micronutrient "basic emergency strategy" to provide minimum daily micronutrient requirements during first 6 months to a year of food assistance. Discusses common micronutrient deficiency problems and treatment options.

Acceptability and use of cereal-based foods in refugee camps: Case-studies from Nepal, Ethiopia, and Tanzania. *1998. Mears, Catherine and Young, Helen. Oxfam Working Paper. 135p. FSRC #7139.*
Reports on nutritional study commissioned by Micronutrient Initiative on use and acceptability of cereal-based foods in refugee camps, as well as opportunities for fortification of cereals with micronutrients at household level. Case studies conducted in refugee camps in Nepal, Ethiopia, and Tanzania, in areas with histories of acute malnutrition and micronutrient deficiencies.

Approaches to the micronutrient fortification of food for displaced populations in Africa: Project report. *1998. Micronutrient Initiative. 27p. FSRC #7415.*
Reports on Refugee Policy Group mission to East Africa under contract by Micronutrient Initiative to "examine how food aid for refugees and other emergency-affected populations could be fortified using in-country processes." Examines fortification of cereals, primarily wheat and maize. Outlines findings and recommendations. Discusses local commercial millers and food processing capacity; stability of food aid; and role of NGOs, Red Cross, WFP, UNICEF, and UNHCR.

Fortification of foods for refugee feeding: An idea whose time has come? *July 1997. Micronutrient Initiative. 6p. FSRC #7611.*
Focuses on fortification of food for refugee feeding activities. Summarizes 1995 George Beaton report on topic. Discusses how to fortify refugee foods, strategic approach, fortification of cereals, research and information needs, and Micronutrient Initiative activities in this area.

Regulation of fortified foods to address micronutrient malnutrition: Legislation, regulations and enforcement, Manual. *Third edition. February 1999. Nathan, Rose. 70p.*
Serves "as a guide for governments wishing to ensure that their food laws and regulations contain adequate provisions for food fortification and related (e.g., enforcement) activities" and assists program managers in understanding regulatory provisions. Available at http://www.sph.emory.edu/PAMM.

Enhancing the nutritional quality of relief diets: Overview of knowledge and experience. *April 1999. Hansch, Steve. 48p.*
Prepared for Enhancing the Nutritional Quality of Relief Diets workshop (April 28-30, 1999, Washington, DC), provides background information on malnutrition in emergencies; humanitarian relief standards for nutrition; approaches to addressing malnutrition in emergencies; use of fresh foods and supplementation; donor country measures to process foods; in-theater fortification and enrichment methods; comparison of food vehicles used; inputs necessary for in-country fortification; IEC, agriculture, and other interventions; and problems associated with vitamin C. Discusses fortification of foods in refugee settings.

Field exchange. Special focus: Micronutrients. *October 1998, Field Exchange, Issue 5. Emergency Nutrition Network. 27p. FSRC #5769.*
Focuses on micronutrients. In addition to wide range of articles on emergency feeding programs, includes sections on micronutrient deficiency diseases among Bhutanese refugees in Nepal and various strategies to address micronutrient deficiencies during emergency situations. Discusses vitamin C fortification of CSB as well as WFP program examining in-country capacity for food fortification.

Nutritional issues in food aid: Papers from the ACC/SCN 19th Symposium. *August 1993. ACC/SCN Symposium Report, Nutrition Policy Discussion Paper No. 12. 97p. FSRC #1051.*
Discusses role of public works, supplementary feeding, and nutrition of refugees in food aid programming. Includes information on micronutrient deficiencies among refugees as well as strategies of food aid programs in addressing these issues. Considers food fortification option.

Vitamin C fortification of food aid commodities. *1997. Institute of Medicine; Committee on International Nutrition; Food and Nutrition Board. 87p. FSRC #7165.*
Discusses cost-effectiveness of scaling up vitamin C fortification in Title II commodities, mainly CSB and WSB, to improve recipients' diet, nutrition and health. Makes recommendations concerning its advisability, discusses alternative mechanisms for providing vitamin C to refugee populations at risk for deficiencies, and identifies areas for additional research.

SUSTAIN results report on the vitamin C pilot program. *1997. SUSTAIN; Ranum, Peter; Chomé, Françoise. 154p. FSRC #6883.*
Contains results of USAID Vitamin C Pilot Program for use by USAID in consultation with National Academy of Sciences to determine appropriate vitamin C fortification levels in food commodities used in U.S. food aid programs. Focuses on two commodities provided in Tanzania and Haiti, CSB and WSB, that were fortified with higher levels of vitamin C.

Global directory of commercial manufacturers of micronutrient premixes and supplements. First edition. *December 1997. Micronutrient Initiative. FSRC #7467.*
Lists manufacturers worldwide that formulate and produce micronutrient premixes and supplements "that meet recognized international standards for production manufacture, quality assurance and use." Includes background information on micronutrients. Includes manufacturers of such fortified foods as salt, sugar, cereals and other flour products, and milk. Available on Micronutrient Initiative website at http://www.idrc.ca/mi/index.html.

On order:

Micronutrient Assessment Project final report. *Forthcoming, September 1999. SUSTAIN.*
Reports on Micronutrient Assessment Project (MAP) three-year study to "determine the level of micronutrients in the fortified food commodities provided in the United States (U.S.) P.L.480 food assistance program which reaches the mothers, children, and refugees targeted by emergency and development feeding programs in developing countries." Lists recommendations for improvements of U.S. food aid program as related to micronutrients.

Food provisioning among Mozambican refugees in Malawi: A study of aid, livelihood and development. *1989. Wilson, K.; Cammack, D.; Shumba, F. Refugee Studies Program.*
Examines trading issues and sale of food by refugees to purchase clothes and other articles.

Thiamine deficiency and its prevention and control in major emergencies. *WHO.*
Provides guidelines on assessment and prevention. Discusses several means of increasing intake of thiamin in an emergency situation, including fortification and supplementation.

Workshop on the improvement of the nutrition of refugees and displaced people in Africa. *1994.*

SPECIALTY FOODS

Provision of blended foods and high energy biscuits in the Great Lakes Region. Mission report (1st draft), 23 January - 26 February, 1998. *Merx, Richard J.H.M. World Food Program,. 48p. FSRC #7617.*
Reports on consultancy to "identify options for cost effective production for WFP of high-energy biscuits and blended food school meals in the Great Lakes Region." Includes pre-assessment of regional "WFP lunch box concept". Presents situation analysis. Discusses formulas, nutritive values, and production process for blended foods and high energy biscuits. Considers capacity requirements for UNIMIX and HEB production. Examines project feasibility and sustainability.

Humanitarian Daily Rations (HDRs) - Draft. *1998. Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict. Office of the Secretary of Defense, Peacekeeping and Humanitarian Assistance. 16p. FSRC #7499.*
Outlines draft guidelines for Humanitarian Daily Rations (HDRs) compiled by Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict. Provides information on specifications (nutritional guidelines, menu composition, preparation requirements, packaging), acquisition, distribution, requesting HDRs, storage/handling, inspection, and program reviews.

Production of pre-cooked fortified blended foods in Kenya: A success story. *1997. Göte, Hertz. Field Exchange. August 1997. 2p. FSRC #5769.*
Discusses Kenya program that developed local production capacity for fortified pre-cooked blended food. The operation has handled millet, wheat, maize, and soya flour and has produced UNIMIX and high protein biscuits. Discusses output, uses, and packaging of blended food as well as challenges faced by factory.

CARE India's RTE experience in Uttar Pradesh (an assessment): Supplementary nutrition food for pre-school children, pregnant women and lactating mothers. *1998. CARE India; Integrated Export & Shipping Services Company Pvt. Limited. 104p. FSRC #7404.*
Discusses CARE India's experience with Ready to Eat (RTE) feeding programs in its Integrated Child Development Services (ICDS) program that provides supplementary nutrition to combat childhood malnutrition. Discusses appropriateness of RTE.

The use of BP-5 biscuits in supplementary feeding programmes. *Assafa, Fitsum. Field Exchange, August 1997. 1p. FSRC #5769.*
Presents lessons learned from supplementary MSF feeding program in Afghanistan that made use of BP-5 biscuits. Discusses operational challenges faced by program when making use of biscuits.

Requirements for effective fortification in food aid programmes. *1995. Dexter, Patricia. FAO Technical Consultation, Food Fortification: Technology and Quality Control, Rome, Italy, 20-23 November 1995. 19p. FSRC #7635.*
Examines "requirements for effective fortification for food aid programs." Considers existing fortification of food aid activities (blended foods, processed cereal, vegetable oil, high protein biscuits, dried skim milk powder, salt, whole grains). Discusses cost and nutritional impact issues, quality assurance, criteria for fortification of food aid, limiting factors, and need for international guidelines. Briefly discusses use of high protein biscuits.

Enhancing the nutritional quality of relief diets: Overview of knowledge and experience. *April 1999. Hansch, Steve. 48p.*
Paper prepared for Enhancing the Nutritional Quality of Relief Diets workshop (April 28-30, 1999, Washington, DC). Provides background information on malnutrition in emergencies; humanitarian relief standards for nutrition; approaches to addressing malnutrition in emergencies; use of fresh foods and supplementation; donor country measures to process foods; in-theater fortification and enrichment methods; comparison of food vehicles used; inputs necessary for in-country fortification; IEC, agriculture, and other interventions; and problems associated with vitamin C. Discusses fortification of the following commodities: grain, flour, CSB, WSB, biscuits, oil, and sugar.

OPERATIONAL ISSUES/PROGRAMMING (Guidelines on Policy, Management, M&E, Quality Control, Assessment Issues)

Fortification rapid assessment guidelines & tool (FRAT). *December 1997. Micronutrient Initiative. 28p. FSRC #7605.*
Presents guidelines "designed to help programmers work through the steps of examining food consumption patterns in order to, first, decide whether fortification could be considered as a viable public health intervention for eliminating vitamin A deficiency in the country, second to identify potential food vehicle(s), and third, to select the most appropriate vehicle(s) for fortification with vitamin A." Developed by PATH Canada under contract by the Micronutrient Initiative, covers target groups, fortification rapid assessment, preliminary assessment, selection of appropriate vehicle, and results analysis.

Anemia detection methods in low-resource settings: A manual for health workers. *December 1997. PATH; OMNI; USAID. 51p.*
Presents anemia detection tests for health workers in settings with limited health care facility resources. Provides instructions for performing tests, suggestions for improving test performance, descriptions of test characteristics, advantages and disadvantages of each test, and required equipment and supplies.

Indicators for assessing vitamin A deficiency and their application in monitoring and evaluating intervention programmes. *1996. WHO Micronutrient Series. 66p. FSRC #6888.*
Presents principles for use of biological indicators for vitamin A deficiency surveillance and discusses each indicator and its limitations. Intended for managers of national programs for prevention and control of micronutrient malnutrition, specifically vitamin A deficiencies. Identifies non-biological indicators.

Peru trip report, September 19-26, 1998. SUSTAIN Micronutrient Assessment Program. *1998. Schlossman, Nina P.; Ranum, Peter; Soria, Andreina. [60]p.*
Reports on study of vitamin A content of samples of P.L. 480 Title II bulgur and wheat flour. Includes information from interviews with Cooperating Sponsors regarding Commodities Reference Guide as well as meetings with millers and other groups regarding fortification. Provides suggestions on how to revise Commodities Reference Guide and presents information on effort to fortify P. L. 480 vegetable oil.

International workshop on micronutrient enhancement of rice, September 2 & 3, 1998, Stuttgart, Arkansas. *1998. University of Arkansas; Micronutrient Initiative; SUSTAIN; ILSI; OMNI. [80]p.*
Summarizes workshop with following objectives: discuss current rice fortification and enhancement technologies; promote better understanding of rice fortification and micronutrient enhancement technologies; and recommend follow-up activities to address micronutrient deficiencies through rice fortification and biotechnology. Includes panel discussion of policy and regulatory considerations for rice fortification.

Workshop on quality control and assurance in milling and fortification of corn masa flour, San Salvador, El Salvador, March 16-17, 1998. *1998. SUSTAIN; McFarlin, Keith; Lopez, Ximena. [70]p.*
Outlines workshop on quality control and assurance in milling and fortification. Focuses on nutrition and fortification issues relevant to industry and public sector participants. Includes discussion of how to improve and make sustainable fortification and quality control programs.

Russia flour enrichment assessment, June 29-July 10, 1998, Trip report. *1998. SUSTAIN; Gies, Bob. [40]p.*
Reports on feasibility assessment tour for fortification in flourmills and bakeries in various regions of Russia. Reports on feasibility of flour enrichment as well as outcomes of meetings with industry representatives in Russia. Includes discussion of operational and programming considerations.

Workshop: The problem of micronutrient malnutrition in the Russian Federation, Moscow, Russia, June 25-July 2, 1997. *1997. SUSTAIN; Ranum, Peter; Turner, Liz; Yeung, David. [45]p.*
Summarizes workshop that reviewed "Russian action plans to address micronutrient deficiencies relating to maternal and child health." Covers scientific, technical, regulatory, and policy issues.

African Micronutrient/Small Enterprise Activity (AMSEA) mission report, Malawi, June/July 1998 (second edition). *1998. SUSTAIN; Hammond, Neal; Wurdemann, Willem; Adams, Tony. [50]p.*
Reports on visit of feasibility assessment team to Malawi for project aimed to reduce malnutrition and develop small and medium business sector. Includes list of recommendations for technical assistance and marketing.

1998 Congress of (AGTA), The Guatemalan Association of Food Technologists, September 8-11, 1998, Trip report. *1998. SUSTAIN; Prakash, Anuradha; Vasconcellos, Andres. [35]p.*
Summarizes conference on "Guatemalan food industry's development through the continuing education of food industry professionals and managers." Presentation topics include nutrition and health issues in food industry; irradiation; modified atmosphere packaging; and functional foods.

Seminar: Packaging - AGTA, Guatemala, May 13-17, 1997. *1997. SUSTAIN; Lindemann, Donald. [40]p.*
Outlines topics discussed at Guatemalan Association of Food Technologists (AGTA) seminar "Trends and Technology in Packaging for the Food and Beverage Industries." Includes presentations on packaging materials.

Workshop series: Food safety and quality, El Salvador, February 4-5, 1997, March 11-12, 1997, May 13-14, 1997. *1997. SUSTAIN. [50]p.*
Reports on workshop series to train food processing company staff in sanitation, hygiene, manufacturing practices, and hazard analysis.

Assessment of soy processing operation, Nicaragua, June 2-8, 1997. *1997. SUSTAIN; Hahn, Richard. [30]p.*
Reports on trip to Nicaragua to examine processing operation to produce soy milk and other soy products. Assesses equipment for soy processing and recommends types of food products.

Regulation of fortified foods to address micronutrient malnutrition: Legislation, regulations and enforcement, Manual. *Third edition. February 1999. Nathan, Rose. 70p.*
Serves as "guide for governments wishing to ensure that their food laws and regulations contain adequate provisions for food fortification and related (e.g., enforcement) activities" and to assist program managers in understanding regulatory provisions. Available at http://www.sph.emory.edu/PAMM.

Sustainable control of vitamin A deficiency: Defining progress through assessment, surveillance, evaluation. *1997. International Vitamin A Consultative Group. 139p. FSRC #6892.*
Reports on XVIII International Vitamin A Consultative Group Meeting in Cairo, Egypt, on September 22-26, 1997. Representatives from 52 countries presented research and programmatic information on implementing effective programs. Includes discussion of food fortification activities as well as gardening programs.

MICAH guide: A practical handbook for micronutrient and health programmes (Draft). *MICAH; World Vision Canada. [200]p. FSRC #7626.*
Serves as handbook for staff involved in Micronutrient and Health (MICAH) program. Describes MICAH program activities. Includes chapters on project proposal development, program monitoring indicators, and design and implementation of surveys.

Food fortification in developing countries. *Nestel, Penelope; USAID. 45p.*
Reviews literature on food fortification with vitamin A, iron, and iodine. Examines determination of fortification levels, issues involved in fortification activities, quality control, monitoring and evaluation of fortification programs, economic issues, and political and legal considerations. Discusses fortification of sugar, wheat flour, corn flour, rice, maize meal, salt, milk, biscuits, and condiments.

Food fortification: Technology and quality control. *FAO Technical Consultation. Istituto Nazionale della Nutrizione, Rome, Italy, 20 to 23 November, 1995. 34p. FSRC #7598.*
Reports on consultation concerning food fortification. Includes summary of conclusions and recommendations as well as background information on food fortification. Contains sections on iodine, iron, and vitamin fortification technologies; legislation information; monitoring procedures; and fortification in food aid programs. Discusses fortification of salt, oils, and cereals. Available at www.fao.org/WAICENT/FAOINFO/ECONOMIC/ESN/fortify/fortify.htm.

Fortification basics: Choosing a vehicle. *OMNI/Roche/USAID. 4p.*
Presents guidelines for choosing a food vehicle for fortification. Discusses criteria for vehicle selection, consumption patterns, marketing and distribution, stability of micronutrients in fortified foods, sensory characteristics, and data sources. Provides information on sugar, wheat flour, corn flour, salt, fats and oils, and milk.

Nutritional issues in food aid: Papers from the ACC/SCN 19th Symposium. *August 1993. ACC/SCN Symposium Report, Nutrition Policy Discussion Paper No. 12. 97p. FSRC #1051.*
Discusses role of public works, supplementary feeding, and nutrition of refugees in food aid programming. Includes information on micronutrient deficiencies among refugees as well as strategies of food aid programs in addressing these issues. Considers food fortification option.

Prevention of micronutrient deficiencies: Tools for policymakers and public health workers. *1998. Institute of Medicine. National Academy Press. 207p. FSRC #7163.*
Reports on and presents background papers from workshop on micronutrient deficiencies, specifically iron, vitamin A and iodine. Provides framework for planning intervention programs and other recommendations. Includes information on fortification programs. FSRC also has summary version - **Prevention of micronutrient deficiencies: Summary and key elements**. *1998. 41p. FSRC #7167.*

Preventing micronutrient malnutrition: A guide to food-based approaches. Why policy makers should give priority to food-based strategies. *1997. FAO, International Life Sciences Institute. 11p. FSRC #7550.*
Gives overview of food-based means to address micronutrient malnutrition. Includes background information on micronutrient malnutrition and discusses measures to prevent and control micronutrient malnutrition as well as implementation and cost of food-based strategies.

Preventing micronutrient malnutrition: A guide to food-based approaches. Manual for policy makers and programme planners. *1997. FAO, International Life Sciences Institute. 105p. FSRC #7549.*
Discusses food-based approaches to combating micronutrient malnutrition and provides guidelines for policy makers for implementing these strategies. Includes sections on increasing small-scale (e.g., gardening programs) as well as commercial production of micronutrient-rich foods, maintaining micronutrient levels in common foods (improved storage, food safety, and preparation), plant selection and breeding, food fortification, and communication strategies.

Requirements for effective fortification in food aid programmes. *1995. Dexter, Patricia. FAO Technical Consultation, Food Fortification: Technology and Quality Control, Rome, Italy, 20-23 November 1995. 19p. FSRC #7635.*
Studies "requirements for effective fortification for food aid programs." Examines existing fortification of food aid activities (blended foods, processed cereal, vegetable oil, high protein biscuits, dried skim milk powder, salt, whole grains). Discusses cost and nutritional impact issues, quality assurance, criteria for fortification of food aid, limiting factors, and need for international guidelines.

Economic rationale for investing in micronutrient programs. A policy brief based on new analyses. *1995. USAID; VITAL. 12p.*
Discusses economic reasons for micronutrient programs, including labor productivity, education, health impacts. Examines economic dividends from micronutrient programs.

Interagency meeting: Iron fortification in the Americas. *March 1998. Pan American Health Organization (PAHO). 9p. FSRC #7597.*
Reports on March 1998 workshop on iron fortification programs. Provides background information on iron deficiency and its prevention and control. Includes discussion of quality assurance and epidemiological surveillance. Examines premix and compound strategies. Includes consensus points, research priorities, and discussion items. Available at www.paho.org/english/hpp/hpn9803.htm.

Enriching lives: Overcoming vitamin and mineral malnutrition in developing countries. *1994. Development in Practice Series. The World Bank. 73p. #5195.*
Presents lessons learned for micronutrient policy and program design purposes. Discusses food fortification, supplementation, targeting, and social mobilization and education. Fortification section addresses voluntary fortification, consumer participation and education, and universal and mandatory fortification.

Micronutrients: Increasing survival, learning, and economic productivity. *1993. USAID. 28p. FSRC #7218.*
Reports on USAID micronutrient program, including topics of iron, vitamin A, iodine, fortification programs, USAID-supported interventions, prevention of disease, and malnutrition.

Sharing risk and reward: Public-private collaboration to eliminate micronutrient malnutrition. Report on the forum on food fortification: International dialogue on micronutrient malnutrition. *1996. Ottawa Forum on Food Fortification; Micronutrient Initiative; Program Against Micronutrient Malnutrition; Keystone Center. 57p. FSRC #7220.*
Reports on Ottawa forum in December 1995 attended by public and private sector leaders to discuss collaborative approach to elimination of micronutrient malnutrition and need to establish national dialogues and other action-oriented linkages.

Combating iron deficiency anemia through food fortification technology: An action plan. *5-7 December 1990 XII INACG meeting, Washington, DC. 11p. FSRC #7631.*
Presents action plan developed at December 1990 International Nutritional Anemia Consultative Group meeting. Outlines plan for developing national iron fortification programs in cooperation with industry, donor agencies, and governments. Focuses on iron fortification of food.

Food-based approaches to preventing micronutrient malnutrition: An international research agenda. Summary report of an international workshop. *1996. G.F. Combs, Jr. et al (eds.). Cornell University (CIIFAD). 68p. #5279.*
Summarizes workshop on food system-based strategies to address micronutrient malnutrition. Includes discussion of micronutrient malnutrition issues; existing knowledge and new knowledge; priority research needs; and action items.

Progress in controlling vitamin A deficiency. *Micronutrient Initiative, UNICEF, Tulane. 1998. 36p.*
Summarizes findings of survey on vitamin A supplementation. Discusses current situation of vitamin A deficiency (VAD) as well as implementation of programs for reducing VAD.

Commodities reference guide (incomplete draft). *April 1999. USAID/Food for Peace.*
Provides information on Title II commodities. Currently posted on http://www.info.usaid.gov/hum_response/crg/ are commodity facts (nutritional content, specifications, storage issues, and shelf life). Part II and Annexes still under construction.

Commodities reference guide. *1988. USAID/Food for Peace. [150]p. FSRC #113.*
Provides information on Title II commodities. Covers ration selection process, commodity selection guidelines, nutritional values for commodities, commodity fact sheets (nutritional content, packaging, and preparation information), packaging and storage, and rodent and insect control. Includes micronutrient values. Updated version forthcoming.

Carotenoids and food preparation: The retention of provitamin A carotenoids in prepared, processed, and stored foods. *1997. Rodriquez-Amaya, Delia B.; USAID; John Snow, Inc./OMNI. 88p. FSRC #7214.*
Covers properties, functions, and actions of carotenoids, difficulties in measuring provitamin A levels, important food sources of provitamin A, as well as effects of home processing and industrial processing on provitamin A content food.

Street foods in developing countries: Potential for micronutrient fortification. *1996. Draper, Alizon; John Snow, Inc./OMNI Project. 8p. FSRC #7230.*
Gives a brief overview of nutritional value of street foods in developing countries and recommendations on how to launch a fortification program.

Street foods in developing countries: Potential for micronutrient fortification. *1996. Draper, Alizon,; USAID; John Snow, Inc./OMNI Project. 67p. FSRC #7231.*
Reviews information on availability, cost, and consumption of street and snack foods in developing countries and assesses potential for fortifying these foods with micronutrients to prevent and control micronutrient deficiencies. Considers such related issues as safety of street foods and their production and sale as a business activity for women.

Fortification update. *No. 1, 1995. UNICEF. 8p. FSRC #7469.*
Fortification update. *No. 1, 1996 7470 4p. FSRC #7470.*
Discusses recent events, upcoming activities, and other news concerning micronutrient fortification. Includes country program updates. Available at www.idrc.ca/mi/fort196.htm and www.idrc.ca/mi/fort195.htm.

On order:

Monitoring vitamin A programs. *1998. Cervinskas, Jenny; Houston, Robin. Micronutrient Initiative. 94p.*
Serves as reference document for program managers on monitoring interventions to eliminate vitamin A deficiency (i.e., supplementation, dietary diversification and food fortification). Introduces key concepts, principles, issues and terminology, provides guidance and monitoring framework, suggests examples of key indicators for measuring progress of these interventions, provides information about monitoring methods and tools, and includes references and sources of technical support.

Preventing iron deficiency in women and children: Consensus on key technical issues. *1999. UNU/UNICEF/WHO/MI. 69p. In preparation.*
Reports on October 1998 UNU/UNICEF/WHO/MI Technical Workshop in New York. Clarifies technical issues to accelerate iron deficiency control programmes. Summarizes issues, clarifies technical points, makes consensus statements, outlines action points for assessment and the integration of multiple interventions; food fortification; oral supplementation; communication for dietary change; integration with public health programmes; safety; monitoring, evaluation, and research. Provides references and sources of technical assistance.

Design and implementation of nutrition surveys. *World Vision Canada. 137p.*

Indicators to monitor impact of nutrition programmes. *World Vision Canada. 66 p.*

Controlling vitamin A deficiency. *1994. Gillespie, Stuart; Mason, John.*

Controlling iron deficiency. *1991. ACC/SCN. Hetzel B.S.*

Prevention and control of iodine deficiency disorders. *1988. ACC/SCN.*

NUTRITION IN EMERGENCIES

WFP/UNHCR guidelines for estimating food and nutritional needs in emergencies.
December 1997. 10p.
Revises guidelines established by UNHCR and WFP for determining food and nutritional needs in emergencies. Presents guidelines for calculating food rations for refugees.

UNHCR/WFP guidelines for selective feeding programmes in emergency situations.
February 1999. 20p.
Provides principles and design guidelines for food and nutrition issues related to selective feeding programs in emergencies and relief settings.

Famine-affected, refugee, and displaced populations: Recommendations for public health issues. *July 1992. MMWR. Centers for Disease Control.*
Compiles information on public health for refugee camps and displaced population programs. Examines nutritional and health problems and present recommendations. Discusses micronutrient malnutrition. Available at http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00019261.htm.

Specific deficiencies versus growth failure: Type I and type II nutrients. *1995. Golden, Michael H.N. SCN News 12: 10-14.*
Examines nutrients that "give rise" to two types of responses: 1) continued growth with specific deficiencies and 2) reduced growth with no specific signs of deficiencies. Outlines differences between type I and II nutrient deficiency and discusses supplementation options.

Enhancing the nutritional quality of relief diets: Overview of knowledge and experience.
April 1999. Hansch, Steve. 48p.
Prepared for Enhancing the Nutritional Quality of Relief Diets workshop (April 28-30, 1999, Washington, DC), provides background information on malnutrition in emergencies; humanitarian relief standards for nutrition; approaches to addressing malnutrition in emergencies; use of fresh foods and supplementation; donor country measures to process foods; in-theater fortification and enrichment methods; comparison of food vehicles used; inputs necessary for in-country fortification; IEC, agriculture, and other interventions; and problems associated with vitamin C.

Fortification of foods for refugee feeding. Final report to the Canadian International Development Agency. *1995. 113p. Beaton, G.H. FSRC #5552.*
Considers role and specifications of fortified foods, existing and potential. Studies nutritional inadequacies of refugee diets and presents strategies to address these deficiencies. Discusses

supplementation, fortification of staple cereal, and promotion of gardens. Considers effectiveness and cost issues, and argues strongly for fortification of staple cereal rather than reliance on blended foods to supply micronutrients for refugee populations.

Fortification of foods for refugee feeding. Technical background report: Derivations and analyses. Report to the Canadian International Development Agency. *1995. Beaton, G.H. 79p. FSRC #5553.*
Provides "supporting technical details" for Fortification of Foods for Refugee Feeding report (see FSRC #5552). Explains derivation of reference nutrient density profiles. Compares fortification and blended foods. Tests use of supplements in non-refugee population. Discusses food composition data used in calculations.

Health care for refugees and displaced people. *1994. Mears, Catherine; Chowdhury, Sue; Oxfam. Oxfam Practice Health Guide No. 9. 112p. FSRC #7160.*
Provides information on provision of health care in emergencies, covering assessment of health-risk factors and needs for health care, e.g, discussion of common diseases, HIV/AIDS, food and nutrition, and conducting surveys. Nutrition sections examine nutritional status, food availability, rations, general feeding, selective feeding, supplementary feeding, therapeutic feeding, and monitoring.

Third report on the world nutrition situation. *1997. UN Sub-Committee on Nutrition (ACC/SCN). 111p. FSRC #6887.*
Provides information on nutritional status of populations in developing countries. Topics include reports on underweight preschool children, information on global and regional trends in stunting, micronutrient malnutrition, and vitamin and mineral deficiencies. Also included is a review of issues related to nutritional status of refugees and displaced persons.

Nutritional issues in food aid: Papers from the ACC/SCN 19th Symposium. *August 1993. ACC/SCN Symposium Report, Nutrition Policy Discussion Paper No. 12. 97p. FSRC #1051.*
Discusses role of public works, supplementary feeding, and nutrition of refugees in food aid programming. Includes information on micronutrient deficiencies.

World Declaration and Plan of Action for Nutrition, International Conference on Nutrition, Rome, December 1992. *FAO; WHO. 1992. 43p. FSRC #667.*
Outlines Plan of Action agreed to by International Conference on Nutrition in 1997. Includes sections on nutrition of refugees, preventing micronutrient deficiencies, and nutrition during famine situations. Presents policy guidelines, intersectoral issues, and strategies.

Human nutrition in the developing world. *1997. FAO. 515p. FSRC #7156.*
Covers nutritional problems of developing countries, providing science-based information on food, nutrients, causes of malnutrition, nutritional disorders and prevention. Includes sections on fortification, outlining information on methods of fortification and suitable foods.

The FSRC holds subscriptions to the following periodicals:

SCN News. *UN ACC Sub-Committee on Nutrition.*
Compiles developments in international nutrition sector. Includes conference summaries, profiles of nutrition projects, announcements, and resource information. Also includes articles on such issues as nutrition surveillance, vitamin deficiencies, fortification, supplementation, training, assessment, vulnerability, and public education.

RNIS (Report on the Nutrition Situation of Refugees and Displaced Populations). *UN Sub-Committee on Nutrition.*
Contains overviews and statistics of nutritional status of refugees and displaced population groups.

ENN, Field Exchange. *Emergency Nutrition Network, Department of Community Health & General Practice, Trinity College, Ireland.*
Includes articles on emergency feeding, supplementary and fortified foods, field nutrition program experiences, micronutrients, measurements and nutrition assessments, and several other issues.

On order:

Nutrition guidelines. *1995. Médecins Sans Frontières.*
Designed to "facilitate the application of fundamental concepts and principles necessary for the assessment of nutritional problems and the implementation of nutritional programs in emergency situations," covers various stages of food programming including nutritional strategies, surveys, and nutritional programs. Discusses wide range of issues including anthropometric surveys, assessments, supplementary feeding, therapeutic feeding, registration, and discharge.

Workshop on the improvement of the nutrition of refugees and displaced people in Africa. *1994.*

AGRICULTURAL APPROACHES TO ADDRESS MICRONUTRIENT MALNUTRITION

Improving nutrition through home gardening: A training package for preparing field workers in Southeast Asia. *1995. Food and Nutrition Division, FAO. 171p. FSRC #7596.*
Includes materials for training agricultural extension agents and field workers in Southeast Asia in home gardening. Covers role of home gardening, nutrition information, household food and nutrition data collection, promotion of home gardening for better nutrition, and home garden technology. Includes course materials for participants and trainers, technical notes for trainers, information sheets, and home gardening technology leaflets.

Mitigation practitioner's handbook. *October 1998. USAID/BHR/OFDA/PMPP. 76p.*
Covers planning for interventions in emergencies. Focuses on prevention, mitigation, and preparedness. Section on seeds and tools programs discusses garden interventions. Includes seeds and tools case studies from southern Sudan and Rwanda.

Promotion of vitamin A garden as a sustainable intervention strategy to promote vitamin A nutrition. *1997. Devadas, Rajammal P.; Chandrasekhar, U.; Avinashilingam Deemed University. 3p. FSRC #7586.*
Presents results of feasibility study on promotion of school gardens to combat vitamin A deficiency in India.

Food from dryland gardens: An ecological, nutritional, and social approach to small-scale household food production. *1991. Cleveland, David A.; Soleri, Daniela. Center for People, Food and Environment. 387p. FSRC #2049.*
Serves as reference book on dryland gardens. Provides overview of gardens in development as well as information on nutritional value of gardens, financial and economic issues surrounding

gardens, monitoring and evaluation of garden projects, garden management, use of harvest from gardens, and measurements, and resources. Nutrition section discusses nutritional needs in dryland areas and impact of gardens on nutrition.

Does urban agriculture help prevent malnutrition? Evidence from Kampala. *1998. Maxwell, Daniel; Levin, Carol; Csete, Joanne. Food Policy, vol. 23, no. 5, pp. 411-424. FSRC #7044.*
Examines impact of urban agriculture on household food security and nutritional status among children under 5 in Kampala, Uganda.

Gardens for Bangladesh: A ten year initiative to sustainably improve the health, nutrition and food security of the poorest in rural Bangladesh. *Helen Keller International. 4p.*
Reports on home gardening program designed to address undernutrition and vitamin A deficiency.

Large-scale model for delivering homestead horticultural technologies in Bangladesh. *1996. Baker, Shawn; Talukdar, Aminuzzaman; Helen Keller International. Micronutrients and Agriculture. 3p.*
Reports on Helen Keller International home gardening program to improve vitamin A status of poor households in Bangladesh.

International workshop on micronutrient enhancement of rice, September 2 & 3, 1998, Stuttgart, Arkansas. *1998. University of Arkansas; Micronutrient Initiative; SUSTAIN; ILSI; OMNI. [80]p.*
Summarizes workshop with following objectives: discuss current rice fortification and enhancement technologies; promote a better understanding of rice fortification and micronutrient enhancement technologies; recommend follow-up activities to address micronutrient deficiencies through rice fortification and biotechnology. Includes panel session on plant breeding and biotechnology approaches to micronutrient content enhancement.

Final summary report, Ten-year food-based action, 1989-1995. *1996. The Vitamin A Programme; FAO. 80p. FSRC #7600.*
Summarizes technical assistance provided during 10 years of UN vitamin A deficiency program. Covers food-based strategies including home, school, and community gardening; production of oil palms and processing of palm oil; promotion of traditional vegetable and fruit crops; seed and seedling distribution; fruit and vegetable preservation; nutrition education; and food and cooking demonstrations. Outlines food-based strategies, achievements and results of activities, constraints, and conclusions.

MICAH matters. *1999. V.4, no. 1. Micronutrient and Health (MICAH). World Vision Canada. 4p. FSRC #7615.*
Includes brief articles on training workshops, small-scale fortification of flour and maize blending systems, vegetable gardening, literacy programs, water and sanitation, and country updates.

Combating micronutrient deficiencies through vegetables - a neglected food frontier in Asia. *1997. Food Policy (vol. 22, no. 1) pp. 17-38. FSRC #6357.*
Studies policy and technology options to integrate micronutrient-rich vegetables in diets. Examines role of vegetables in overcoming micronutrient deficiency; trends of vegetable consumption in Asia; and supply problems and other constraints. Discusses drawbacks of fortification and food supplement strategies and looks at home-gardening approach.

Solar drying for vitamin A. *1993. Vitamin A Field Support Project, VITAL; USAID. 47p. FSRC #6858.*
Serves as basic instruction manual on construction and use of solar dryer and methods for preserving vitamin A-rich foods for VITAL programs. Designed as program guide for use by field and community-level development workers and trainers working with community groups to promote increased production and consumption of vitamin A-rich foods.

Enrichment of food staples through plant breeding: New strategy for fighting micronutrient malnutrition. *1996. Bouis, Howarth. IFPRI. Nutrition Reviews. v.54(5): 131-137. FSRC #7177.*
Explores possibilities of enriching grains with micronutrients through plant breeding to improve nutritional value of food.

Linking adaptive and process research to improve technology development and dissemination. *CGIAR. 5p. FSRC #7627.*
Examines organic and inorganic soil fertility technologies and types of research that need to be linked to ensure soil fertility advances. Presents case study of research on use of fertilizers to address micronutrient deficiencies for maize in Malawi. Describes research sequence and outputs.

Improving iron status through diet: Application of knowledge concerning dietary iron bioavailability in human populations. *1997. Allen, Lindsay H.; Ahluwalia, Namanjeet. 83p. FSRC #7212.*
Reviews current knowledge about important factors affecting dietary iron bioavailability. Integrates available information on iron bioavailability in a way that is useful for designing the most effective and practical strategies to improve absorption of iron from specific staple foods and diets.

Angola agricultural programmes: An ICRC evaluation. *Field Exchange, Issue 5. 2p. FSRC #5769.*
Reports on impact evaluation of ICRC agricultural activities in Angola. Includes information on seed distribution programs in the region.

Distributing seeds and tools in emergencies. *1998. Johnson, Douglas. Oxfam. 96p. FSRC #7528.*
Presents guidelines for programs distributing seeds and tools in emergency situations. Discusses concepts surrounding seeds and tools projects, information needed to develop seeds and tools distribution programs, initial assessment work, project design, technical information on seeds and tools, project implementation, and relationship between these interventions and development. Includes seed selection and nutritional information.

Sustainable control of vitamin A deficiency: Defining progress through assessment, surveillance, evaluation. *1997. International Vitamin A Consultative Group. 139p. FSRC #6892.*
Reports on XVIII International Vitamin A Consultative Group Meeting held in Cairo, Egypt, on September 22-26, 1997, in which representatives from 52 countries presented research and programmatic information on implementing effective programs. Includes discussion of food fortification activities as well as gardening programs.

Preventing micronutrient malnutrition: A guide to food-based approaches. Manual for policy makers and programme planners. *1997. FAO, International Life Sciences Institute. 105p. FSRC #7549.*
Discusses food-based approaches to combating micronutrient malnutrition and provides guidelines for policy makers on implementing these strategies. Includes sections on increasing small-scale (e.g., gardening programs) as well as commercial production of micronutrient-rich foods, maintaining micronutrient levels in common foods (improved storage, food safety, and preparation), plant selection and breeding, food fortification, and communication strategies.

On order:

IFPRI working papers on agricultural strategies for micronutrients:

Breeding for staple crops with high micronutrient density. *1996.*
Household behavior and micronutrients: What we know and what we don't know. *1995.*
Human nutrition: Food and micronutrient relationships. *1995.*

Plant breeding: A long-term strategy for the control of zinc deficiency in vulnerable populations. *FCND Discussion Paper 30. IFPRI.*

Determinants of demand for micronutrients: An analysis of rural households in Bangladesh. *FCND Discussion Paper 32. IFPRI.*

Vitamin A deficiency: Scientific progress and links to policy. *1995. Bouis, Howarth; Mason, J. Beyond Nutritional Recommendations: Implementing Science for Healthier Populations Symposium, 5-7 June, 1995, Washington. DC.*

SUPPLEMENTATION

Guidelines for the use of iron supplements to prevent and treat iron deficiency anemia. *1998. Stoltzfus, Rebecca J.; Dreyfuss, Michele L.; INACG; WHO; UNICEF. 39p.*
Presents guidelines on appropriate use of iron supplements to treat iron deficiency anemia in public health programs. Provides recommendations for use of iron supplements in anemia control programs. Addresses prevention and treatment of anemia.

Iron/multi-micronutrient supplements for young children. Summary and conclusions of a consultation held at UNICEF, Copenhagen, Denmark, August 19-20, 1996. *Nestel, Penelope and Alnwick, David. 8p.*
Reports on results of meeting held to discuss following iron supplementation issues: iron supplementation for child under 2 years of age; dosage; duration of supplementation; and combining iron supplementation with other minerals and vitamins.

Specific deficiencies versus growth failure: Type I and type II nutrients. *1995. Golden, Michael H.N. SCN News 12: 10-14.*
Examines nutrients that "give rise" to two types of responses: 1) continued growth with specific deficiencies and 2) reduced growth with no specific signs of deficiencies. Outlines differences between type I and II nutrient deficiency and discusses supplementation options.

Fortification of foods for refugee feeding. Final report to the Canadian International Development Agency. *1995. 113p. Beaton, G.H. FSRC #5552.*
Considers role and specifications of existing and potential fortified foods. Studies nutritional inadequacies of refugee diets and presents strategies to address these deficiencies. Discusses supplementation, fortification of staple cereal, and promotion of gardens. Considers effectiveness and cost issues, and argues strongly for fortification of the staple cereal rather than reliance on blended foods to supply micronutrients for refugee populations.

Fortification of foods for refugee feeding. Technical background report: Derivations and analyses. Report to the Canadian International Development Agency. *1995. Beaton, G.H. 79p. FSRC #5553.*
Provides "supporting technical details" for Fortification of Foods for Refugee Feeding report (see FSRC #5552). Explains derivation of reference nutrient density profiles. Compares fortification and blended foods. Tests use of supplements in a non-refugee population. Discusses food composition data used in calculations.

Iron interventions for child survival. *1995. Nestel, Penelope (ed.). USAID; OMNI; ICH. 170p.*
Outlines proceedings of a London workshop organized by USAID/OMNI and Institute for Child Health to address efforts to reduce and control iron deficiency anemia in infants and young children. Discusses fortification of foods (cereal flours, beverages, and milk) and supplementation.

Weekly iron intervention: The case for intermittent iron supplementation. *1998. Beard, John L. American Journal of Clinical Nutrition, v. 68. 4p. FSRC #7621.*
Discusses debate on intermittent versus daily iron supplementation programs. Examines data from studies in Indonesia, China, and Bolivia. Calls for weekly iron supplementation.

Combating iron deficiency: Daily administration of iron is far superior to weekly administration. *1998. Hallberg, Leif. American Journal of Clinical Nutrition, v. 68. 5p. FSRC #7622.*
Examines debate on daily versus weekly administration of iron supplementation. Looks at mucosal block argument and pregnancy issues. Calls for daily supplementation.

Strategies for promoting vitamin A production, consumption, & supplementation: Four case studies. *1996. USAID; Academy for Educational Development; OMNI. FSRC #7211. 79p.*
Reports on USAID experiences in affecting behavioral changes in vitamin A supplementation. Includes case studies in Niger, Philippines, and Indonesia.

Vitamin A supplements: Guide to their use in the treatment and prevention of vitamin A deficiency and xerophthalmia. *1997. WHO/UNICEF/IVACG Task Force; World Health Organization. 27p. FSRC #7169.*
Presents case for vitamin A supplementation to treat xerophthalmia and other infections. Guide to preparations and dosages.

Effectiveness of vitamin A supplementation in the control of young child morbidity and mortality in developing countries. *1992. International Nutritional Program; University of Toronto; Beaton, G. H.; Martorell, R.; L'Abbé, K. A. 160p. FSRC #7203.*
Presents summary and full report to Canadian International Development Agency of vitamin A project conducted by University of Toronto International Nutrition Program.

Vitamin A deficiency and its consequences: Field guide to detection and control. Third edition. *1995. Sommer, Alfred; World Health Organization. 70p. FSRC #7172.*
Serves as guide for detecting and controlling vitamin A deficiency. Discusses assessment and evaluation; conducting surveys; and treatment and control options. Includes information on fortification as well as supplementation.

Global vitamin A initiatives. *July/August 1998, Issue #6. PATH Canada. 2p. FSRC #7606.*
Includes "Universal distribution of vitamin A supplements: A guide to their use in the prevention of vitamin A deficiency and xerophthalmia." Discusses target population and dosing schedule and provides tips. Examines Canadian Physicians for Aid and Relief (CPAR) vitamin A project activities.

Micronutrient deficiencies in Latin America and the Caribbean: Iodine, calcium, and zinc. *Mora, Jose O.; Mora, Olga L. PAHO/WHO; USAID; Roche; OMNI. 33p.*
Provides overview of micronutrient deficiencies in Latin America and the Caribbean. Focuses on iodine, calcium, and zinc. Discusses salt iodization and zinc supplementation. Includes both English and Spanish language text.

Micronutrient deficiencies in Latin America and the Caribbean: Vitamins. *Mora, Jose O.; Mora, Olga L. PAHO/WHO; USAID; Roche; OMNI. 41p.*
Provides overview of micronutrient deficiencies in Latin America and the Caribbean, specifically focusing on vitamins. Discusses supplementation and food fortification (sugar, wheat and corn flour, milk, rice, vegetable oil, margarine, and infant cereals). Includes both English and Spanish language text.

Enriching lives: Overcoming vitamin and mineral malnutrition in developing countries. *1994. Development in Practice Series. The World Bank. 73p. #5195.*
Presents lessons learned for micronutrient policy and program design purposes. Discusses food fortification, supplementation, targeting, and social mobilization and education. Supplementation section focuses on training and support of health care workers, supply issues, programming, and targeting.

Enhancing the nutritional quality of relief diets: Overview of knowledge and experience. *April 1999. Hansch, Steve. 48p.*
Paper prepared for the Enhancing the Nutritional Quality of Relief Diets workshop (April 28-30, 1999, Washington, DC). Provides background information on malnutrition in emergencies; humanitarian relief standards for nutrition; approaches to addressing malnutrition in emergencies; use of fresh foods and supplementation; donor country measures to process foods; in-theater fortification and enrichment methods; comparison of food vehicles used; inputs necessary for in-country fortification; IEC, agriculture, and other interventions; and problems associated with vitamin C. Supplementation section discusses distribution of vitamin C and vitamin A capsules and tablets.

On order:

Effect of zinc supplementation on the weight gain of Somali refugee children recovering from moderate protein-energy malnutrition. *1992. Robertson, J. Save the Children UK.*

Vitamin A supplementation for refugees and famine victims. *1988. Nieburg, P.; Waldman, R.J.; Leavell, R.; Sommer, A.; De Maeyer. E.M. Bulletin of the World Health Organization 66 (6): 689-697.*

Presents argument for distribution of vitamin A supplements in emergencies to prevent measles and child mortality.

Thiamine deficiency and its prevention and control in major emergencies. *WHO*.
Provides guidelines on assessment and prevention. Discusses several means of increasing intake of thiamin in an emergency situation, including supplementation.

USEFUL FORTIFICATION WEBSITES

PFEDA Project
http://www.univ-lille1.fr/pfeda
Contains PFEDA (Partners and Food in Emergency and Development Aid) database of information on relief foods. Provides nutritional and logistical information on relief food items. Includes fortification information. Posts archives of NGONUT discussions, which include fortification topics.

Emergency Nutrition Network (ENN)
http://www.tcd.ie/ENN
Describes ENN and its activities and provides links to other useful sites. Posts articles from Field Exchange, several of which focus on fortification issues.

Program Against Micronutrient Malnutrition
http://www.sph.emory.edu/PAMM/
Includes technical reports, information sources, Micronutrient Malnutrition News issues, and links to other sites.

Opportunities for Micronutrient Interventions (OMNI)
http://www.jsi.com/intl/omni/home
Outlines OMNI activities. Posts information on several OMNI publications, which include fortification topics. Provides links to OMNI partners and other useful links.

Federation of American Scientists (FAS) Micronutrient Project
http://www.fas.org/mnp/
Provides background information on micronutrients and project activities, links to publications and other sites. Posts issues of Micronutrients and Agriculture, a newsletter focusing on research on plant breeding strategies for improving micronutrient nutrition.

The Micronutrient Initiative
http://www.idrc.ca/mi/index.html
Describes Micronutrient Initiative's mission and approach to fulfilling its mandate, as well as brief description of MI program framework. Includes MI's activity highlights, publication lists, summary workplan, micronutrient information sources, on-line directory of premix and supplement manufacturers, listings of events, data and relevant articles, links to other agencies involved in elimination of micronutrient deficiencies, and MN-Net database.

MN-Net, A Global Micronutrient Network
http://www.idrc.ca/mi/mnnet.htm
Houses MN-Net, micronutrient network of Micronutrient Initiative (Ottawa, Canada), designed to facilitate access to data and information on micronutrient malnutrition. Contains data from relevant databases maintained by WHO, UNICEF, International Center for the Control of Iodine

Deficiency Disorders, USAID, and Micronutrient Initiative.

SUSTAIN
http://www.sustaintech.org
Outlines SUSTAIN activities in nutrition and fortification. Posts SUSTAIN publications.

United Nations, Administrative Committee on Coordination/Sub-Committee on Nutrition (ACC/SCN)
http://www.unsystem.org/accscn/
Contains news updates and issues of *RNIS* and *SCN News*. Also provides access to Third Report on the World Nutrition Situation and other publications. Includes links to other sites.

Specialty Foods Vendors:

Breedlove Dehydrated Foods
http://www.breedlove.org/index.html
Provides overview of Breedlove Dehydrated Foods and their products.

Survivor Industries, Inc.
http://www.survivor-ind.com/
Contains information on Survivor Industries, Inc., which manufactures Mainstay product. Includes Mainstay nutritional information.

BASF, Human Nutrition page
http://www.basf.com/businesses/consumer/humannutrition/
Overview of BASF nutrition products and activities, including fortification work.

Defense Supply Center Philadelphia pages:
http://www.dpsc.dla.mil/subs/rations/hdr.htm
Provides background and nutritional information on Humanitarian Daily Ration (HDR).
http://www.dpsc.dla.mil/subs/rations/mres.htm
Provides background and nutritional information on Meals, Ready-to-Eat (MREs).

If you would like copies of materials that appear on this bibliography, or if you have any questions regarding these resources or other topic areas, please contact

Technical Information Specialist
Food Aid Management/Food Security Resource Center
300 I Street, N.E., Suite 212
Washington, DC 20002
202-544-6972 (phone), 202-544-7065 (fax)
e-mail address: jgraef@foodaid.org
website URL: www.foodaid.org